CHAPTER 5
Meeting and Managing Future Water Demands (2000-2025)

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In moving from issue identification/analysis to solution development, several water source options were considered to address the water supply issues identified in **Chapter 4**. Eight water source options were initially identified for consideration in the Upper East Coast (UEC) Planning Area to meet existing and future demands. These options either make additional water available from historically used sources or other sources (e.g., the Floridan Aquifer), or provide improved management of the sources (e.g., conservation). The options considered were (no implied priority):

- Aquifer storage and recovery
- Conservation
- Floridan Aquifer
- Seawater
- Reclaimed water
- Reservoirs
- Surface water
- Surficial Aquifer

Development of each of these options could be the responsibility of regional and/or local entities.

In this chapter, water resource development and water supply development as it applies to implementation of the recommendations of this Plan are defined, and the opportunities and roles of each of the source options on a regional scale in meeting the urban, agricultural and environmental water needs are discussed. For each option, a description of the option and summaries of relative information is provided under definition and discussion. This is based mostly on the topics that were discussed at the public workshops. Estimated costs, quantity of water potentially available and implementation strategies are provided for each option. The implementation strategies provide the basis for the recommendations in **Chapter 6**.

WATER RESOURCE DEVELOPMENT AND WATER SUPPLY DEVELOPMENT

Chapter 373 of the Florida Statutes (F.S.) requires that water supply plans include a list or menu of water source options for water supply development for local water users to choose from. For each water source option listed, the estimated amount of water available for use, the estimated costs, potential sources of funding and a list of water supply development projects that meet applicable funding criteria should also be provided. In addition, water supply plans must also include a listing of water resource development projects that support water supply development. For each water resource development project listed, an estimate of the amount of water to become available as a result of that recommendation, timetable, funding and who will be responsible for implementation, should be provided. The estimated amount water potentially available and the costs to develop that source from a regional perspective are provided in this chapter. Specific recommendations to develop that source option, costs associated with implementation, timetable, estimated amount that would be made for use, the entity responsible for implementation and potential funding sources for each recommendation are contained in **Chapters 6** of this Plan.

Section 373.019, F.S. defines water resource development and water supply development as follows:

> "Water resource development" means the formulation and implementation of regional water resource management strategies, including the collection and evaluation of surface water and groundwater data; structural and nonstructural programs to protect and manage water resources; the development of regional water resource implementation programs; the construction, operation, and maintenance of major public works facilities to provide for flood control, surface and underground water storage, and groundwater recharge augmentation; and related technical assistance to local governments and to government-owned and privately owned water utilities.
>
> and,
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> "Water supply development" means the planning, design, construction, operation, and maintenance of public or private facilities for water collection, production, treatment, transmission, or distribution for sale, resale, or end use.

For the purposes of this Plan, it was concluded the District is responsible for water resource development to attain the maximum reasonable-beneficial use of water; to assure the availability of an adequate supply of water for all competing uses deemed reasonable and beneficial; and to maintain the functions of natural systems. Local users have primary responsibility for water supply development and choosing which water source options to develop to best meet their individual needs. For an option to be a water resource development project, the following should be considered:

- Addresses more than one resource issue.
- Addresses a variety of use classes (e.g., environment, public water supply).
- Protects/enhances resource availability for allocation.
- Moves water from water surplus areas to deficit areas.
- Regional application of technology.

For an option to be a water supply development project, the following should be considered:

- Localized implementation of technology.
- Delivery of resource to consumer.
- Regionalized interconnects to consumer.

OPPORTUNITIES AND ROLES

The water source options were reviewed to assess their potential on a regional scale for meeting the water supply needs of the UEC Planning Area and are presented in **Table 12**. The table indicates the ability of each option to meet the identified need, except for inland environmental needs. For inland environmental needs, the response shows the ability of that option to reduce demands from the Surficial Aquifer, potentially enhancing nearby natural systems.

The relative ability of each source option in this table was based on regional volumes (supply and demand), and does not universally reflect the publics' sense of importance of that option. For example, significant emphasis was placed on the importance of increased conservation to promote more efficient use of water, although from a regional perspective, the volume of water that could be made available through conservation is relatively low compared to other water source options and the overall need. At the local level, the potential of each option may change based on the specific needs of that local situation. From a volume perspective, options that can significantly (relatively) make more water available would be scored high. Elements of conservation are incorporated with the use of each of these options.

In **Table 12**, an entry of high (H) indicates the option, based on volume, has a high potential to address the associated category's water supply needs. A medium (M) entry indicates the option has a medium potential and a low entry means there is low potential to address water supply needs. The high, medium and low entries are relative to one another.

These options are menu items that local water users should consider in meeting their individual water needs. In many cases, several options will be used to meet demands depending on the specific situation.

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Table 12. Potential of Water Source Options in Meeting 2025 UEC Water Supply Needs.

Water Source Option	UEC Water Supply Needs				
	Public Water Supply	Urban Irrigation Demands	Agricultural Irrigation Demands	Freshwater Needs of Estuarine Systems	Inland Environ-mental Needs[c]
Aquifer Storage and Recovery	L	L	L	H	L
Conservation[a]	L	L	L	N/A	L
Floridan Aquifer System	H	L	M	N/A	H
Reclaimed Water	L	M	L	N/A	H
Reservoirs	L	L	M	H	L
Seawater[b]	L	L	L	N/A	L
Surface Water	L	L	H	H	L
Surficial Aquifer System	M	M	L	N/A	L

L=Low; M=Medium; H=High; N/A=Not Applicable

a. Generally cost effective and although does not yield volumes comparable to other options, is considered highly effective in contributing to long-term, climate-proof resources.

b. Potentially large volume could be made available but determined not cost effective at this time.

c. Ability of option to reduce demands from SAS, potentially enhancing nearby natural systems.

WATER SOURCE OPTIONS AND STRATEGIES

Each water source option is discussed to identify its potential for use in the UEC Planning Area. For each water source option, the following information is presented: definition and discussion, estimated costs to develop that option, the quantity of water potentially available from that option and potential implementation strategies.

Aquifer Storage and Recovery (ASR)

Aquifer storage and recovery (ASR) is the underground storage of injected water into an acceptable aquifer (typically the Floridan Aquifer System in south Florida) during times when water is available, and the later recovery of this water during high demand periods. In other words, the aquifer acts as an underground reservoir for the injected water, reducing water loss to evaporation.

In 2002, there were five ASR wells in the District with operations permits using treated drinking water or partially treated surface water. There were 15 ASR wells under operational testing, and over ten wells under construction. There are no ASR facilities in the UEC. In addition to these utility uses, the District, in cooperation with the U.S. Army Corps of Engineers (USACE), is pursuing regional ASR systems as part of the Comprehensive Everglades Restoration Plan (CERP). Almost 400 ASR wells are planned around Lake Okeechobee and other significant sources of water, such as major canals.

Treated Water ASR

Treated water ASR involves using potable water as the injection water. Since potable water meets drinking water standards, this type of ASR application is more easily permitted. There are many examples in Florida of utilities using treated water ASR, including several in the SFWMD. These include Collier County, Miami-Dade County, Lee County and the City of Boynton Beach Utilities.

Raw Water or Partially Treated ASR

Raw water or partially treated ASR involves using groundwater from freshwater aquifers or surface water. Some treatment may be necessary prior to injection to meet the appropriate standards. Raw water or partially treated ASR is usually discussed in combination with surface water storage, such as a reservoir or canal system. The reservoir or canal system would capture excess surface water and provide sufficient volumes of water for the ASR injection cycle. In lieu of withdrawing surface water directly from a surface waterbody, potential projects may involve installation of vertical and/or horizontal wells, and use of the soil matrix between the waterbody and well intake for filtration, sometimes referred to as bank filtration. This type of ASR could be used as a supplemental source to reclaimed water for irrigation use.

Reclaimed Water ASR

Reclaimed water ASR involves using reclaimed water as the injection water. Several communities in Florida are interested in reclaimed water ASR and are investigating the feasibility of such a system. In 2002, two utilities in the Tampa Area initiated operational testing of ASR systems using reclaimed water. Some modification to treatment systems or installation of additional treatment components may be necessary to meet applicable standards. There are no reclaimed water ASR wells in the SFWMD.

Fate of Microorganisms in Aquifers Study

The SFWMD, in conjunction with others, is conducting a Fate of Microorganisms Study to evaluate the fate of coliform bacteria and other biological constituents (e.g., bacteria, viruses, protozoa) during storage through ASR wells in brackish aquifers. Limited available data suggests that natural bacterial, geochemical and physical processes that occur underground around an ASR well cause rapid die-off of pathogenic microorganisms, particularly in brackish aquifers prevalent in much of the District. Current Florida Department of Environmental Protection (FDEP) interpretations of the Underground Injection Control (UIC) regulations necessitate treatment to drinking water standards to eliminate coliform bacteria in recharge water. If a reasonable case can be

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made through testing and monitoring that sufficient treatment occurs naturally in the aquifer within a zone around the well, then recharge pretreatment and associated costs can possibly be reduced. Therefore, efforts to confirm and document such underground natural processes are needed to provide a firm foundation for legislative or regulatory actions that would help to achieve these potential cost savings without jeopardizing groundwater quality or public health. A risk-based comparison of potential benefits may then be performed, including consideration of the cost savings to Florida taxpayers and water consumers, and also any potential risks associated with proposed reduction in pretreatment requirements.

The study is being conducted in a phased approach to further investigate the pathogen die-off phenomenon reported via subsurface storage. During Phase I, a literature search was conducted to document existing literature regarding the fate of coliform bacteria and other biological constituents during subsurface storage. Also during Phase I, laboratory experiments were conducted by investigating the effects of varying temperature and salinity values on pathogenic microorganisms. With the recent completion of Phase I and generally positive results, the SFWMD is considering conducting in-situ testing in Phase II of the study with a technique known as diffusion chambers. The diffusion chambers allow water to pass through, but the seeded pathogenic microorganisms are retained within the chamber. Therefore, the chambers can be lowered into a well and the effects of subsurface conditions (i.e., aquifer water quality, geochemistry, native microorganisms, pressure, etc.) can be evaluated, while still protecting public health. Should these tests prove successful, a risk-based strategy could be conducted via Phase III to store non-disinfected water in the subsurface. The District is awaiting approval from regulatory agencies regarding the proposed Phase II work. Once approved, a detailed scope of work must be developed before Phase II work could commence.

Aquifer Storage and Recovery - Estimated Costs

Estimated costs for an ASR system depend on the type of the ASR system. Estimated costs for 2 MGD potable water ASR system and a 5 MGD surface water ASR system are provided in Chapter 3 of the Support Document. A 2 MGD drinking water ASR system has an estimated total construction cost of $990,000 and an annual operations and maintenance cost of $83,300. This equates to a cost of about $0.44 per 1,000 gallons. A 5 MGD surface water ASR system with microfiltration has an estimated total construction cost of $6.54 million and an annual operations and maintenance cost of $364,781. This equates to a cost of about $1.05 per 1,000 gallons.

The potable water cost information assumes the ASR well will be located at the water treatment plant site and have a 70 percent recovery rate. The surface water ASR cost information assumes the ASR facilities will be located at a remote site, microfiltration treatment of the water being injected, and a 70 percent recovery rate.

Aquifer Storage and Recovery - Quantity of Water Potentially Available

The volume of water that could be made available through ASR wells depends upon several local factors, such as well yield, water availability, variability in water supply and variability in demand. Without additional information, it is not possible to accurately estimate the quantity of water that could be available through ASR. Typical storage volumes for individual wells range from 10 to 500 million gallons per cycle or 31 to 1,535 acre-feet (Pyne, 1995). Where appropriate, multiple ASR wells could be operated as a wellfield, with the capacity determined from the recharge and/or recovery periods. The storage time is usually seasonal, but can also be long-term or for emergencies. The volume of water that could be made available by any specific user must be determined through the District's Consumptive Use Permit (CUP) Program.

Aquifer Storage and Recovery - Implementation Strategies

Listed below is a potential strategy developed in cooperation with the public that should be considered in the development of plan recommendations regarding aquifer storage and recovery:

Utilities should explore ASR, among other options, to extend the use of current resources in order to meet future demands, including addressing peaks in demands or in availability of resources. ASR could be used to extend drinking water reclaimed water supplies during peak demand periods.

Conservation

The overall water conservation goal of the state shall be to prevent and reduce wasteful, uneconomical, impractical or unreasonable use of water resources.

As an alternative to the development of new water supply, water conservation programs can provide additional water from traditional sources, usually at a lower cost. The least-expensive water is the water that utilities have already developed, while new source development for reverse osmosis has been estimated to cost as much at $2.00 per 1,000 gallons.

Water Conservation as a Water Resource Option

The 1998 UEC Water Supply Plan (1998 Plan) concluded that historically used sources of water, primarily fresh groundwater sources, are not sufficient to meet the projected demands through the planning horizon. The 1998 Plan recommended new sources of water be explored and used, including the Floridan Aquifer System (FAS) and increased use of reclaimed water, increased water conservation and research, to meet the projected demands, to reduce the potential for harm to wetlands and the water resources. The Plan also recommended more efficient use of water by increasing urban and agricultural water conservation and developing cost-sharing partnerships.

Conservation is vitally important for the fast-growing UEC Planning Area. Population in the region is projected to increase by about 50 percent from 2000 to 2025. More and more, water conservation is being regarded as an important component in integrated water resource management. That is, in addition to offsetting demands on traditional water resources and reducing impact on natural systems by developing alternative water supplies, such as desalination, aquifer storage and recovery and reclaimed water for reuse, water conservation or demand reduction, has become a factor in the equation. Measures to use water more efficiently can be less expensive than projects to augment supply and have other important advantages, such as reducing stress on natural systems. Water saved can be used to meet new needs, in effect expanding current water supplies, and protecting the environment. In addition to environmental benefits, and augmenting water supplies, water conservation projects are often easier to implement than supply projects due to easier permitting, lower costs and acceptance by the public.

Evaluating Conservation in the Water Supply Planning Process

Statewide, in concert with the FDEP, water management districts agreed to conduct evaluations of water conservation in the water supply planning process. That is, water conservation is regarded as a potential source of supply, and as such, estimates of supply are performed through evaluation of data and potential best management practices. These evaluations include an assessment of water conservation opportunities in the planning area and potential measures for improving water use efficiency, assessment of the measures determined to be the most feasible, and programs to implement the alternative(s). Recommendations include funding sources, responsible parties and timetables. Potential for water conservation measures can be found in each of the following sectors:

1. General Policy Considerations
2. Agricultural Irrigation
3. Landscape Irrigation
4. Water Pricing
5. Industrial/Commercial/Institutional
6. Indoor Water Use

Practices and technologies that provide reductions in per capita water uses consist of both long-term, permanent reductions, and short-term reductions, which may result from temporary behavior changes. Long-term reductions generally result from implementation of technologies, such as ultralow flow plumbing/irrigation devices and water pricing strategies that encourage efficient water use. This is in contrast to short-term water conservation measures and cutbacks made by users during water shortage situations.

A Statewide Effort: Florida's Water Conservation Initiative

In response to growing water demands, water supply problems and one of the worst droughts in Florida's history, the FDEP led a statewide Water Conservation Initiative (WCI) to find ways to improve efficiency in all categories of water use. Hundreds of stakeholders participated in the WCI, which addressed all water use classes, and subsequently offered alternatives to save water. Fifty-one cost-efficient alternatives were published in the document entitled *The Florida Water Conservation Initiative, 2002*. A full list of the 51 alternatives may be found in Chapter 3 of the Support Document. In addition to policy and regulatory measures, the following six alternatives were the highest-ranked of the WCI alternatives:

Agricultural Irrigation presents many opportunities for improved efficiency. Key among these are cost share programs to implement irrigation Best Management Practices, more use of mobile irrigation labs to evaluate irrigation efficiency, improvements in the recovery and recycling of irrigation water and greater use of reclaimed water for irrigation.

Landscape Irrigation for watering lawns, ornamental plants and golf courses can be significantly reduced through more efficient irrigation system design, installation and operation, and by reducing the amount of landscaping that requires intensive irrigation.

Water Pricing, or rate structures, informative utility billing and other techniques can send appropriate price signals to encourage water users to conserve water.

Industrial, Commercial and Institutional users can improve water use efficiency through certification programs for businesses that implement industry-specific Best Management Practices, and through water use audits, improved equipment design and installation and greater use of reclaimed water.

Indoor Water Use is a growing water use sector. The greatest potential for conserving water in this sector is through increasing the number of Florida homes and businesses that use water-efficient toilets, clothes washers, showerheads, faucets and dishwashers.

Reuse of Reclaimed Water can be used more efficiently through pricing and metering.

Joint Statement of Commitment

The "Joint Statement of Commitment for the Development and Implementation of a Statewide Comprehensive Water Conservation Program for Public Water Supply", or JSOC is a written agreement by key water supply partners in Florida to collaborate on measures to improve water use efficiency. (A copy of the "Joint Statement of

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Commitment" may be obtained from the Florida Department of Environmental Protection Office of Water Policy -- 850-245-8677, http://www.dep.state.fl.us/water/waterpolicy.)

The Joint Statement resulted from discussions on how to best implement the public water supply recommendations in the Florida Water Conservation Initiative.

Improved water conservation will benefit all water users, both economically and environmentally, and will also help to ensure the sustainability of Florida's water resources. Allowing public water supply utilities the flexibility to tailor cost-effective goal-based, accountable, and measurable water conservation programs to reflect their individual circumstances will result in greater water use efficiency.

The signatories of the Joint Statement are the Florida Department of Environmental Protection; the South Florida Water Management District; the St. Johns River Water Management District; the Southwest Florida Water Management District; the Northwest Florida Water Management District; the Suwannee River Water Management District; the Florida Public Service Commission; the Utility Council of the American Water Works Association, Florida Section; the Utility Council of the Florida Water Environment Association; and the Florida Rural Water Association.

Based on the principles of the Joint Statement, the signatories are now developing a work plan with specific tasks, interim milestones, completion dates, estimates of costs, and assignments of responsibilities. The work plan is to be completed by February 2005 and will include recommendations for:

- Developing standardized definitions and performance measures for water conservation data collection and analysis.
- Establishing a clearinghouse for water conservation that will provide an integrated statewide database, technical assistance capabilities, and continual assessment of the effectiveness of water conservation programs and practices.
- Developing and implementing a standardized water conservation planning process for utilities.
- Developing and maintaining a Florida-specific water conservation guidance document.
- Implementing pilot applications of various elements of the program, or the entire program, through cooperative agreements with volunteer utilities.

Assessing Water Conservation Opportunities in the Upper East Coast Planning Area

The initial assessment of water conservation opportunities in the planning area began with staff considering all 51 recommendations of the WCI. The second step of the assessment was to determine the highest ranked most applicable and implementable alternatives. Alternatives that may have been ranked highly by the WCI, but are outside the scope of this water supply plan or the District's authority to require, assist or fund, were not analyzed.

The Initial Assessment

The initial assessment considered the six sectors itemized previously in this section. Efficient use of reclaimed water was also included in the assessment.

General Policy Considerations

Assessment of the potential for water conservation in the UEC included reviewing potential cooperative funding programs or incentives to support cost effective projects within all sectors of water use that promote increased efficiency of water use, administrative code development and expand and coordinate education and outreach programs.

Education and Outreach

Each of the following sectors of water use has necessary outreach and education components. Although quantification of a specific amount of water saved as a result of an outreach and education effort is not as readily measured as with water saving devices or technology, outreach and education are crucial to any successful conservation program.

Comprehensive outreach and education programs usually involve a three-pronged approach: awareness, education and adoption of action. *Awareness* is the process of conveying to users, an awareness of their behavior (i.e., water use), and communicating the importance of conserving the resource. The next step, *education*, consists of providing appropriate information to users to enable them to understand that taking an action, or embracing a concept will result in water savings, and/or other benefits. The last step, *action*, results when the user is aware and educated and is actively seeking a solution to conserve. This final step prepares users for technology-based alternatives.

Successful outreach and education efforts usually consist of cooperation between many agencies and organizations. For example, outreach through school education can provide the basis of long-range acceptance and action of the conservation message by future generations. Public water supply utilities can play an important role through their customer service and billing processes. The District and the other participating state agencies have consistently provided assistance to the wide range of water users through outreach and education programs.

Mobile Irrigation Laboratories (MILs)

Mobile Irrigation Laboratories (MILS), specialized labs on wheels, provide recommendations to improve irrigation systems, and are discussed further in this chapter.

MILs are excellent examples of cooperative funding partnerships, often involving federal, state and local entities, which also provide education and outreach.

Agricultural Irrigation Cost Sharing Programs

Cost Share Incentive was a highly ranked alternative by the WCI stakeholders. Traditionally, agricultural cost-share incentives have been funded through state and federal agencies (e.g., Florida Department of Agriculture and Consumer Services and the U.S. Natural Resources Conservation Service). Example programs include agricultural irrigation system retrofits employing efficient technologies.

Water Savings Incentive Program (WaterSIP)

The SFWMD provides cost-share funding for programs that employ devices to increase water savings. The Water Savings Incentive Program (WaterSIP) was established in Fiscal Year 2002 to provide funding for projects that conserve water. WaterSIP focuses on projects that are not capital improvements, such as installing automatic shutoff devices for irrigation systems and plumbing retrofits. To date, the WaterSIP has committed a total of $700,000 in cooperative funding for 19 projects. The program is Districtwide, and will save hundreds of thousands of gallons of water each day. For example, for the eight projects funded in fiscal year 2003, once installed, these projects will save an estimated 171 million gallons a year. Projects are identified for funding through a Request for Proposals solicitation and project selection process. In addition to public water suppliers, other entities wishing to cost-share in water saving programs are eligible, e.g., homeowner’s associations and public/private partnerships. There have not been any projects funded in the UEC to date.

Projects that are identified through the evaluation of water conservation alternatives that present the best opportunity for water savings for the UEC and will likely score higher in the proposal criteria for the WaterSIP.

The District also provides cost-share funding for utilities and local government outreach and education activities. SFWMD Regional Service Centers provide coordination and education for outreach projects for the general public or specific use sectors.

Regulatory Measures

SFWMD water use permitting rule amendments adopted in January 1993 require specific water conservation elements for public water supply utilities (and associated local governments), commercial/industrial users, landscape and golf course users and agricultural users. The requirements are summarized in **Table 13**. These requirements must be addressed to obtain individual water use permits. For more information on regulatory water conservation measures, please refer to the Consolidated Water Supply Support Document (SFWMD, 2004).

Table 13. Regulatory Conservation Measures.

Public Water Supply Utilities	Commercial/ Industrial Users	Landscape/ Golf Course Users	Agricultural Users
• Adopt irrigation hours ordinance • Adopt Xeriscape™ landscape ordinance • Adopt ultralow volume fixtures ordinance • Adopt rain sensor device ordinance • Adoption water conservation-based rate structure • Implement leak detection and repair program • Implement water conservation public education program • Analyze feasibility of reclaimed water	• Audit water use • Implement cost-effective conservation measures • Implement employee conservation awareness program • Develop an implementation plan • Analyze feasibility of reclaimed water	• Use Xeriscape™ for new and modified projects • Install rain sensor devices or switches • Irrigate between 4 p.m. and 10 a.m. only • Analyze feasibility of reclaimed water	• Use micro irrigation for new and existing systems • Analyze feasibility of reclaimed water

Agricultural Irrigation

Agricultural irrigation is the largest water use category in the UEC Planning Area. There are several potential water conservation opportunities in agricultural conservation, including irrigation system conservation, water table management and other best management practices. The existing agricultural mobile irrigation laboratories play an important role in facilitating more efficient use of water within agriculture.

Landscape Irrigation

Landscape Irrigation includes statewide standards for landscape irrigation and includes the development and adoption of standards, with inspections, and is the responsibility of the state, under the State Building Code.

Educational and outreach programs on water efficient landscaping are conducted by the Cooperative Extension Services of the University of Florida, Institute of Food and Agricultural Sciences (IFAS).

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Water Pricing

Water conservation rate structures have been required by SFWMD rule since 1993. A statewide study funded by Florida's water management districts was initiated in 2003 to evaluate the effectiveness of the rate structures currently employed by utilities. In addition to analyzing the impact of conservation-based water pricing on revenues, the study will also analyze the effect of these rate structures on water use – participating utility customers will be surveyed. The study is scheduled for completion in 2005.

Industrial/Commercial/Institutional

Industrial/Commercial/Institutional water use in the UEC Planning Area represents a minor portion of the overall demand, and in the initial assessment was not considered significant enough to warrant detailed evaluation.

Indoor Water Use

Indoor water use accounts for a major portion of demands on public water supply. Plumbing retrofit programs were one of the WCI's highest-ranked alternatives. Plumbing retrofits were recommended in the 1998 Plan. This alternative is evaluated in detail below, using specific data for each county in the UEC.

Efficient Use of Reclaimed Water

Reuse of reclaimed water will significantly address water resource issues in the planning area, since it has been concluded that urban landscape irrigation could not continue to rely solely on the Surficial Aquifer to meet future demands. Furthermore, analyses showed that these demands could be met with a combination of Surficial Aquifer water and reclaimed water. Efficient use of reclaimed water is strongly encouraged and may be achieved through metering and pricing. Evaluation of the reclaimed water alternative is discussed in detail in the reclaimed water section of this chapter.

Detailed Evaluation of the Most Feasible Alternatives – UEC Water Supply Plan

As stated earlier, the 1998 UEC Water Supply Plan recommended plumbing retrofits for both interior plumbing fixtures and installation of rain switch devices on automatic landscape irrigation systems; and the continuation/expansion of the Mobile Irrigation Labs Program in the UEC.

For the 2004 Plan, the most feasible alternatives were general policy, agricultural irrigation, landscape irrigation, water pricing and indoor water use. As noted before, following the initial assessment, a detailed evaluation of the identified "best measures" was performed. Options with the greatest potential water savings were identified; factors that shape the data were collected, such as laws, ordinances and administrative code changes (District rules) and age of housing stock in the UEC were considered and analyzed. Finally, an analysis of the methods and water savings were conducted. Funding mechanisms for the recommended alternatives are also discussed in this section.

Other Non-Regulatory Conservation Measures and Incentives

Agriculture

Citrus is the dominant crop in the UEC Planning Area. Over 80 percent of the citrus acreage in the planning area is now using low-volume technology or microirrigation, the remaining acreage uses flood irrigation. Much of the acreage using flood irrigation is located in Chapter 298 Districts (Chapter 298, F.S.) where several growers use water sequentially. Conversion of citrus acreage now using flood irrigation could result in significant water savings if converted to microirrigation.

Since 1992, the United States Department of Agriculture, Natural Resources Conservation Service (USDA-NRCS) and the Indian River Lagoon Mobile Irrigation Lab have been promoting water conservation through conversion of flood irrigation systems to low volume technology. The USDA-NRCS has facilitated these conversions by cost sharing, using the Environmental Quality Improvement Program (EQIP). In 2003, over 80 percent of citrus acreage in the region has been converted.

Agricultural Best Management Practices (BMPs)

The Best Management Practices (BMP) Program was developed to help farmers improve water quality. These are voluntary programs developed in cooperation with specific agricultural commodity groups. The commodity groups that presently have BMP programs in place or under development are Cattle, Citrus (Indian River area and Ridge area), Green Industries (landscape, nurseries and golf courses), Horses, Silva-culture (forestry) and Vegetables.

The statewide BMP Program is authorized by Section 403.067, F.S. and the specific authority for the Indian River Citrus BMP Program in Rule 5M-2, F.A.C. Section 403.021, F.S, mandates the SFWMD’s involvement in the BMP Program.

The Indian River Area Citrus BMP is the most significant program in the UEC. Examples of BMPs for the Indian River Area Citrus include scheduling of irrigation and drainage, monitoring of soil moisture and water table management. There has been a high level of enrollment in the voluntary program in the UEC. **Table 14** shows the percentage of citrus acres enrolled in the program by county.

Table 14. Percent of Citrus Acreage Enrolled in the Indian River BMP Program in the UEC Planning Area.

County	Potential Acres[a]	Enrolled Acres	Percent Enrolled
Martin	44,746	33,576	75%
Okeechobee[b]	12,170	9,349	77%
St. Lucie	98,889	93,272	94%
Total	155,805	136,196	87%

Source: FDACS Notice of Intents Status Reports 1/28/2003
a. Florida Agricultural Statistics Service data
b. Includes all of Okeechobee County

One of the major incentives to join the program is a cost sharing arrangement with Florida Department of Agriculture and Consumer Services (FDACS) on implementation costs.

Several state, federal and local agencies are involved in the program. FDACS administers the program. The FDEP sets allowable pollution limits called Total Maximum Daily Loads (TMDLs) for nutrients. Resource Conservation and Development Corporations and Soil and Water Conservation Districts provide local support for BMP programs. The University of Florida IFAS evaluates individual grove owners' BMP compliance and has written the Indian River Citrus BMP Manual. The USDA-NRCS provides technical assistance and some additional cost sharing for the program. The SFWMD provides financial and technical assistance for the program startup.

Mobile Irrigation Lab Program

The Mobile Irrigation Lab (MIL) Program began in south Florida in 1989 with an agricultural lab on the Lower West Coast. The mission of the labs is to demonstrate and educate agricultural and urban water users on how to irrigate efficiently. There are currently nine labs operating in 11 of the 16 counties within the SFWMD boundaries. Funding is a multi-agency partnership between federal, state, regional and local levels of government. The agencies currently funding MILs are the USDA-NRCS, the District and the District's Big Cypress Basin Board, various Soil and Water Conservation Districts, the FDACS and various county and local governments. Over the past 4 years, recommendations for improvements to irrigation systems have yielded average annual potential water savings of 3.35 billion gallons per year. Plans to start additional labs within the District boundaries are underway.

In the UEC Planning Area, there are two urban labs, one in St. Lucie County and one in Martin County. There is also an agricultural lab that provides evaluations in both St. Lucie and Martin Counties. The St. Lucie County urban lab has been in operation since 2000. The urban lab in Martin County has been in operation since 1998. Together, these urban labs have saved about 370 MGY since their inception. The Agricultural lab has performed evaluations since 1992; since 1998, the lab has saved 2,367 MGY.

UEC Urban Water Conservation

Utilities in the UEC have historically promoted water conservation through traditional methods, such as public outreach and customer information techniques. The utilities in this region have implemented water conservation requirements of the CUP process as described above, resulting in implementation of water conservation programs and adopted conservation ordinances.

Several utilities have conducted small-scale retrofit projects. In this Plan, a more detailed analysis of supplementary water conservation practices/projects will be discussed to offer recommendations to expand efforts of the region's water suppliers.

The approach to evaluating the best conservation measures for the UEC was an iterative one. The evaluation process entailed identifying characteristics of the planning area, such as age of housing stock, that would likely determine the type or respective age of technology of indoor plumbing devices, and characterizing use patterns by service area and per capita trends (**Table 15**).

Table 15. Examples of How Alternatives are Evaluated.

Planning Area Characteristic	Best Opportunity	Conservation Measure
Indoor - Older housing with inefficient indoor plumbing fixtures	Retrofits	Plumbing (e.g., toilets, showerheads, etc.)
Outdoor - irrigation systems that do not respond to rainfall	Retrofits	Rain shut-off switches
New development	Local ordinances/ codes/regulatory measures	Varies from code enforcement to landscape technology, such as Xeriscape™

Indoor Retrofit

Two significant changes occurred in plumbing standards in 1983 and 1994, which effected residential water use. In 1983, Chapter 553, F.S., was modified, lowering the maximum allowable flow rates for water fixtures in new construction: a maximum use of 3.5 gallons per flush for toilets and a flow rate of 3.0 gallons per minute (GPM) for showerheads. Prior to this state legislation, the typical volume of water for toilet flushing was 6.0 gallons and showerhead flow was 6.0 GPM.

In 1994, new plumbing standards for water use were implemented under the Federal Energy Policy Act of 1992, setting national plumbing code standards of 1.6 gallon per flush for toilets, 2.5 GPM for showerheads and 2.0 GPM for faucets.

Age of Housing Stock

In order to determine urban areas with the greatest potential for retrofits in the UEC, a housing stock analysis was performed using age of housing as a determinate of the age and water use characteristics of plumbing fixtures. County property assessors parcel data for Martin and St. Lucie Counties provided the number and age of residential units.

To determine housing with greater potential for indoor retrofits, age of the residential units was compared to years when the plumbing code changed as described above (pre-1984, 1984-1994, 1994-2000). **Table 16** shows the number of units and percentages of housing in each group for Martin and St. Lucie Counties.

Table 16. Age of Housing Stock in Martin and St. Lucie Counties (Indoor Retrofit).

County	Housing Stock			
	Pre 1984	**1985-1994**	**Post 1994**	**Total**
Martin	25,435 59%	14,250 33%	3,717 8%	43,402
St. Lucie	30,844 49%	24,474 39%	7,561 12%	62,879
Totals	56,279 53%	38,724 36%	11,278 11%	106,281

Indoor - Water Savings

Utilities that would benefit most from plumbing fixture retrofits are those with significant housing in the pre-1984 age category, and thus have the most potential for indoor water savings.

In Martin County, ten of 16 utilities had a majority of housing stock in their service areas that was older than 1984. For the remaining six utilities, the majority of housing stock in their service areas was older than 1994. In St. Lucie County, four of nine utilities had a majority of housing stock older than 1984. A complete listing of housing stock by age and utility service area can be found in **Appendix E**.

Water savings derived from retrofitting pre-1984 housing to current standards is 4.4 gallons per flush for toilets, and 3.5 GPM for showerheads. Toilets are estimated to be flushed five times a day, with ten minutes per shower as a standard estimate. According to the 2000 U.S. Census, number of persons-per-household was 2.23 in Martin County and 2.47 in St. Lucie County.

Therefore, annual savings from retrofitting one unit from the pre-1984 technology to current standards would be 32,000 gallons for each retrofitted showerhead and 20,075 gallons for each retrofitted toilet.

For the purposes of this approach, it is assumed that a retrofit program would include 75 percent of the pre-1984 housing stock. This percentage is normally used as an estimate of operational coverage in any urban retrofit program. Using the county housing age data in **Tables 16** and **17**, and assuming the 75 percent retrofit, the total potential annual savings of a showerhead retrofit is 1.7 MGD for Martin County and for 2 MGD for St. Lucie County for a total of -3.7 MGD for the planning area.

Similarly, using the housing age data in **Tables 16** and **17**, and assuming the 75 percent retrofit, total annual savings of a toilet retrofit for Martin County is 1 MGD and 1.3 MGD for St. Lucie County, for a total of 2.3 MGD for the planning area.

Total annual savings for both toilet and showerhead retrofit is 2.7 MGD for Martin County and 3.3 MGD for St. Lucie County for a total of 6 MGD. This estimate assumes one retrofit of each device per housing unit.

Indoor - Retrofit Cost

Costs for toilet retrofits are $200 per retrofit, and $20 per showerhead, as described in the Support Document. Water conservation cost efficiency is expressed in 1,000 gallons of water saved annually. Toilet retrofits cost $.25 per 1,000 gallons of water saved, and showerhead retrofits cost $.06 per 1,000 gallons of water saved.

Whenever indoor water use is reduced, there is also a reduction in wastewater. Wastewater flows have been estimated to be as much as 50 percent of residential water use. Impacts to wastewater treatment facilities and the need for expansion and disposal can be reduced if water use is reduced.

Outdoor Retrofit

Age of Housing Stock

For this evaluation, water savings derived from retrofit of outdoor systems, namely installation of rain sensors for housing stock built prior to 1992, is estimated. Based on the county housing age data in **Tables 16** and **17**, and assuming 75 percent of the housing units are retrofitted, a total savings of 5.0 MGD was estimated for the planning area (2.1 MGD for Martin County and 2.9 MGD for St. Lucie County).

Installing rain sensors in irrigation systems of housing units constructed prior to the 1991 Xeriscape™ Landscaping law, which required rain sensors, as well as Xeriscape™ landscape, would result in the greatest savings. Data for **Table 17** were obtained from county property assessors parcel data as previously described.

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Table 17. Age of Housing Stock in Martin and St. Lucie Counties (Rain Sensor).

County	Housing Stock		
	Pre 1992	**Post 1992**	**Total**
Martin	37,920 87%	5,482 13%	43,402
St. Lucie	52,540 84%	10,339 16%	62,879
Total	90,460 85%	15,821 15%	106,281

To determine housing with the greatest potential for outdoor retrofits, age of the housing unit was compared to the law related to rain switch changed (pre-1992 and post-1992). The percentages of units constructed in the two time periods are described below for each county.

Outdoor - Water Savings

A 1987 District Survey of Water Use indicated that 70 percent of all residential irrigation in the District is done by in ground automatic irrigation systems, which are required to have a rain sensor as reflected in the law.

Outdoor - Retrofit Cost

Rain sensors can provide a significant reduction in water use for nominal cost. The cost is estimated to average $68 including installation, and can save 27,000 gallons per year, which equates to a cost of $0.25 per 1,000 gallons. The useful life of a rain sensor is estimated to be ten years. Areas benefiting the most from a rain sensor retrofit program would be pre-1994 housing units with in-ground irrigation systems.

Urban Mobile Irrigation Labs

In the UEC Planning Area, there are two urban labs, one in St. Lucie and one in Martin County. Mobile irrigation lab personnel evaluate the effectiveness of irrigation systems and then make recommendations on how the system can be made more efficient. The result is savings in water, energy, time and money for the user.

Conservation – Quantity of Water Potentially Available

Table 18 highlights three examples of public water supply utility characteristics, and a culling of the best-fit water conservation measures recommended for each utility area characteristic.

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Table 18. Recommended Measures for Conservation for Planning Region.

Housing Stock Characteristic	Conservation Measure	Water Savings per Retrofit Device	Cost per Device	Cost per 1,000 gallons	Planning Area Savings Based on Retrofit of 75% of Characteristic Housing Stock
Housing Built Before 1984	Showerhead retrofit	3.5 gallons/minute	$20	$.06/1,000	3.7 MGD
Pre-1992 Outdoor Irrigation Systems Without Rain Sensors	Rain sensor installation	74 gallons/day	$68	$.25/1,000	5 MGD
Housing Built Before 1984	Toilet retrofit	4.4 gallons per flush	$200	$.25/1,000	2.3 MGD
Planning Area Savings					11 MGD

Conservation - Conclusions

Based on the costs and water saving potential of methods described in this chapter, the preliminary estimates are:

1. Showerhead retrofit to ultralow-flow fixtures, in housing built prior to 1984.
2. Rain sensor installation for most UEC utilities' service areas, particularly new construction.
3. Toilet retrofits to ultralow-flush fixtures in housing units built prior to 1984.
4. Continue rule development of Rule 40E-2, F.A.C., Basis of Review for Water Conservation, in keeping with the Statewide Water Conservation Initiative, which proposed "goal based" water conservation programs for water supply utilities, and Best Management Practices/ Best Available Technologies by industries and other large scale water users.

Table 19 provides a general list of recommended conservation measures that would be effective in different types of utility service areas based on the population growth rate, housing stock and potential for growth.

Table 19. Utility Characteristics and Conservation Methods.

Type of Utility	Characteristics of Utilities	Utility Specific Recommendations
Housing Large Growth Potential	Considerable existing housing stock of intermediate to old age, significant land available for new development	Indoor retrofits, Xeriscape™ ordinance, irrigation hours ordinance, outreach & education
Moderate Growth Potential	Existing housing stock intermediate in age, moderate potential for development - limited by boundaries of other utility service areas and natural areas	Indoor retrofits, Xeriscape™ ordinance, irrigation hours ordinance, promote Mobile Irrigation Lab, outreach & education
Limited Growth Potential	Housing stock is older, service area is near build out, very limited potential for growth	Indoor retrofits, rain switch installation, promote Mobile Irrigation Lab, outreach & education

Conservation – Implementation Strategies

Listed below are potential strategies for water conservation that were developed in cooperation with the public that should be considered in developing plan recommendations regarding conservation.

A. Landscape irrigation water conservation has the potential for significant water savings, and has the potential to reduce Surficial Aquifer System resource issues. This may be accomplished by expanding mobile irrigation lab activity in the planning area, and may involve local government funding partnerships to increase lab services, especially in newer urban communities.

B. Local governments should consider developing ordinances to address water-conserving landscape installation for new construction to maximize water savings in initial design and operation of both residential and commercial sites.

C. Implement cost effective indoor and outdoor retrofits in the UEC Planning Area, based on the above analyses.

D. Conclude water conservation rulemaking for Chapter 40E-2, F.A.C., and Water Use Basis of Review for Water Conservation Requirements, emphasizing goal-based conservation programs for public water suppliers and major water users.

E. Fund projects through the Water Savings Incentive Grant Program, including public/private partnerships, which further the above recommendations.

F. Expand outreach and education through funding, public/private partnerships, the media, professional organizations and users.

Floridan Aquifer System

The Upper Floridan Aquifer is the principal source of supply to users of the Floridan Aquifer System (FAS) in the planning area. The top of the FAS lies approximately -300 feet National Geodetic Vertical Datum (NGVD) in the northwest corner of the planning area, then dips to the southeast to more than -900 feet NGVD in southeast Martin County. For most of the planning area, the Floridan Aquifer is artesian; the wells flow naturally at land surface without the need for a pump. Water in the FAS is brackish in the UEC Planning Area. Additional information on the hydrogeology of the FAS in the UEC is provided in the support document.

The Upper Floridan Aquifer is used extensively by citrus growers in the UEC, primarily as a supplemental irrigation source when surface water availability is limited and as a primary source in areas where no surface water is available. Water from the Floridan is generally blended with surface water or water from the Surficial Aquifer to reduce potential problems associated with salinity. Excess salinity of irrigation water can result in decreased citrus production/yield, reduction in root growth, and can be fatal to specific root stocks (Syvertsen *et al.* 1989). Construction of storage reservoirs associated with the Indian River Lagoon – South Study will enhance surface water availability and should reduce the use of the Floridan Aquifer by the citrus industry.

Most coastal utilities in the region, including Fort Pierce Utilities Authority, Port St. Lucie, Martin County Utilities, South Martin Regional Utility, Plantation Utilities and Sailfish Point currently use water from the Floridan Aquifer as a source of drinking water. A number of smaller private coastal facilities use water from the Floridan Aquifer as a primary source for potable water. Water from the Floridan Aquifer is nonpotable throughout the planning area and requires desalination or blending prior to potable use. Utilities in the UEC Planning Area use reverse osmosis treatment to provide potable quality water. Water from the Floridan Aquifer accounted for 20 percent of total utility withdrawals in the UEC Planning Area in 2000 as shown in **Figure 8**. This is an increase from the 1998 usage, where Floridan Aquifer water accounted for 16 percent of the total utility withdrawal. Most of the utilities in the UEC Region plan to use water from the Floridan Aquifer to meet increases in potable water demand.

The 1998 Plan analysis indicated the Floridan Aquifer has the potential of supplying sufficient water to meet all public water supply demands through the planning horizon, while meeting the supplemental water needs of agricultural users during a 1-in-10 year drought event without exceeding the resource protection criteria.

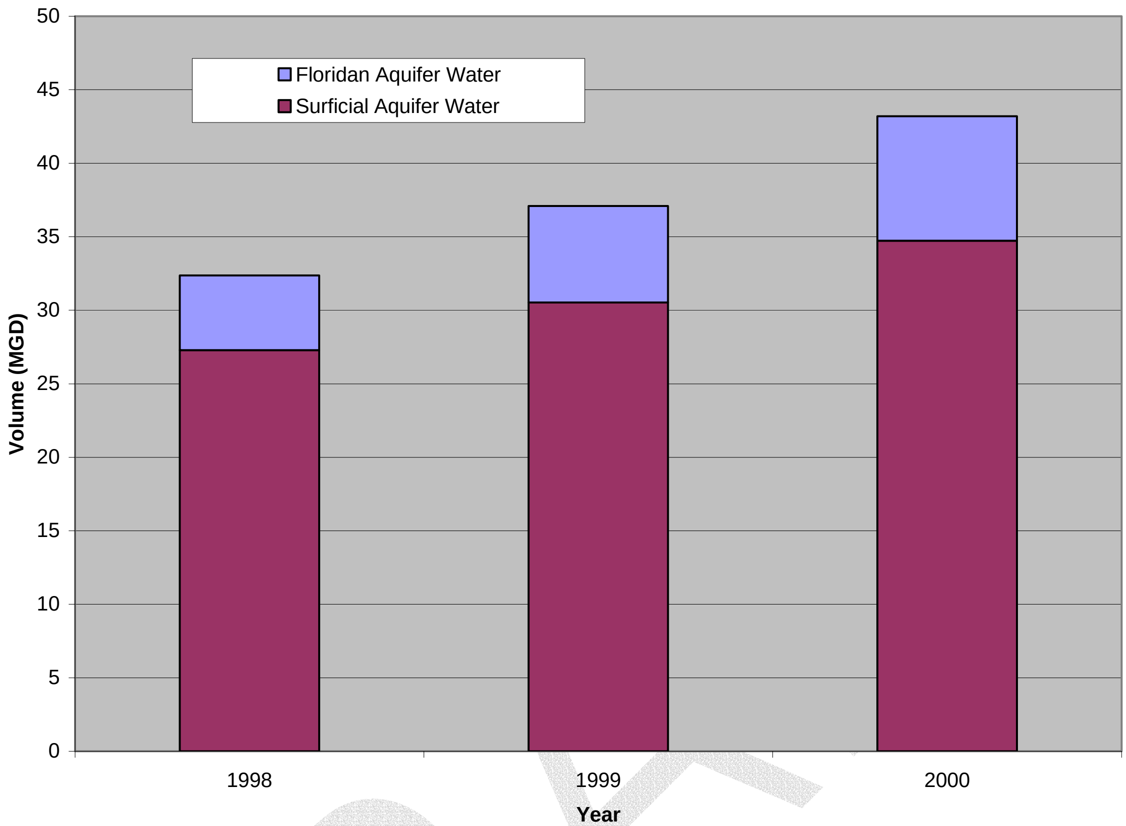

Figure 8. Potable Water Utilities Water Sources (1998-2000).

Floridan Aquifer Monitoring Program

The relationship between water levels, water quality and water use needs to be better understood. A comprehensive Floridan Aquifer monitoring well network was established to monitor the effects of sustained withdrawals on the aquifer pursuant to the recommendations in the 1998 Plan. The purpose of the Floridan Aquifer monitoring network is to provide water level, water quality and water use data in high use areas (citrus groves) to determine statistical trends and relationships between the three data sets. Understanding these relationships will aid in the allocation of water from the Floridan Aquifer, and planning for long-term water supply in the region.

Monitoring began in 1999 at many of the locations in the monitoring well network. Four public water supply sites are being added to the network in 2004. A detailed summary of the network and data collected to date is provided in **Appendix E**. Additional data are needed to reach conclusions on the relationship between water levels, water quality and water use. Continued monitoring of this network is recommended. It is also recommended that public water supply wells be incorporated in to the network.

The SFWMD also co-funded a study with the United States Geological Survey (USGS) to evaluate potential water quality changes and the distribution of salinity in the

Floridan Aquifer. The final report from this study is scheduled for release in mid-2004. The aim of the study was to identify potential sources of high salinity and potential flow mechanisms or pathways of groundwater to wells, and describe areas with a high potential for increasing salinity. The preliminary results found that water levels in the Floridan Aquifer in central and northern St. Lucie and Okeechobee Counties have declined within recent years (2 to 4 feet in the last 15 years, 15 to 20 feet since predevelopment times). The head declines coincide with areas of agricultural use. These inland areas also have some structural deformation in the rock formations that could be preferential pathways for groundwater flow. An area of elevated chloride concentration exists inland trending northwest through north-central Martin County and western St. Lucie County. The investigation concluded that the highest potential for upward or lateral movement of the saltwater interface is in the inland areas of St. Lucie and Okeechobee Counties because of large declines in hydraulic head, areas of structural deformation and areas of higher salinity.

Floridan Well Inventory

It is estimated that there are several thousand wells that penetrate the Floridan Aquifer in the UEC. Most of these are for agricultural water supply and were drilled decades ago. There have been several initiatives over the past 15 years to inventory these wells; and to provide assistance to well owners to install operable wellheads on free flowing wells, and decommission wells that are no longer used or are in a state of disrepair. Some of these past inventories have been titled “Abandoned Floridan Well Inventory”; however, many of the wells in the inventories are permitted as active withdrawal sources through the District’s CUP Program. Under a consumptive use permit, withdrawal facilities must be maintained in good operating condition.

Because many of these wells were drilled decades ago, there is concern about their condition. Well casings, typically made of steel in older wells, could be corroded below the ground surface and wellheads could also be corroded. In addition, many of these wells are short-cased, where these wells do not have a casing for the entire depth of the well into the Floridan Aquifer, such that the wells could be open to the Floridan Aquifer and also to the base of the Surficial Aquifer. Since the Floridan Aquifer is under greater hydrostatic pressure than the Surficial Aquifer, water could be flowing from the salty Floridan Aquifer to the fresh Surficial Aquifer through the well bores. There was also concern expressed about the fate of these Floridan wells as citrus groves are converted to urban development. These wells should be properly decommissioned prior to conversion of the land to residential use.

The renewal of all Individual and Major General Water Use Irrigation permits within the UEC Region began in 2003. The renewal process in the UEC Region is staggered by basin, with the last basin expiring on October 30, 2004. The renewal process consists of review and reissue of irrigation permits in accordance with current District rules. Many of the irrigation permits in the UEC Region were last issued in the 1980s. As part of the current renewal process, the District will update the existing Floridan well

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inventory. Withdrawal facilities that are no longer operational or active will have to be rehabilitated or properly decommissioned.

To ensure Floridan wells are addressed as land formerly used for citrus production is developed for urban uses, there have been discussions of using the District's Environmental Resource Permitting (ERP) process and/or the District's CUP Program to notify developers of the presence of Floridan Aquifer wells. An Environmental Resource Permit must be obtained before beginning any activity that could affect wetlands, alter surface water flows or contribute to water pollution, which includes urban development of most lands. If the proposed development is going to have associated self-supplied water use, a CUP will have to be obtained. As part of the processing of either of these two types of permits, the Floridan well inventory would be used to identify the existence of Floridan wells. Floridan wells not proposed for future use would have to be properly decommissioned. This process will also increase public awareness of Floridan wells.

Decommissioning Assistance for Floridan Wells

There was considerable discussion at the public participation workshops of programs to assist landowners in decommissioning Floridan wells that are no longer in use. There have been several programs that provided technical assistance and cost-share funds for decommissioning Floridan wells in the past. Decommissioning (sometimes referred to as plugging) generally consists of filling the entire well with grout. Past funding and technical assistance has been provided by the District, the Natural Resources Conservation Service, the St. Lucie Soil and Water Conservation District, Treasure Coast Resource Conservation and Development Council and the United States Department of Agriculture's (USDA) Environmental Quality Incentive Program (EQIP). In the UEC Planning Area, over 400 wells have been decommissioned or rehabilitated by these programs over the last 15 years, including all known free-flowing wells.

In the future, these agencies should continue to provide technical assistance, including increasing public awareness through assisting new land owners in locating Floridan wells on their property using the District's well inventory. One funding option discussed was the citrus industry could pursue a state appropriation for funding assistance for a regional approach towards decommissioning Floridan wells.

Effects of Floridan Aquifer Use on Surficial Aquifer

In the 1998 Plan, monitoring data and other related information regarding impacts of Floridan water use on the water quality in the Surficial Aquifer System were reviewed. The data indicated some elevated total dissolved solids concentrations in the Surficial Aquifer in western and central St. Lucie County. However, this was generally limited to less than 50 feet below land surface. There are some residential self-supply wells in these areas, but they are generally greater than 50 feet deep. Based on this information, it was recommended that no further activity was needed. No additional data was reviewed for this Plan.

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Future Modeling and Analysis

Much of the Floridan Aquifer predictive modeling and analysis that has been completed to date in the UEC has been focused on water levels in the aquifer. A comprehensive Floridan Aquifer monitoring well network has been established to collect information on water use, water levels and water quality. It is recommended that a density dependent (water quality) model be developed and used in the next five-year update to conduct predictive analysis on water quality in the Floridan Aquifer.

Floridan Aquifer - Estimated Costs

The costs related to development of the Floridan Aquifer System for water supply are provided in Chapter 3 of the Support Document. The costs to develop the Surficial Aquifer include drilling the well, pumps and treatment facilities, if necessary. For potable water use, desalination treatment is required, such as reverse osmosis. Drilling of a Floridan Aquifer well is a function diameter and depth. For a 1,000-foot well, the estimates for drilling range from $150,000 for a 10-inch cased well to $320,000 for a 24-inch cased well. The water that can be withdrawn from an individual well is very site specific and varies across the UEC Planning Region. Current regulations for the region prohibit the withdrawal of water from a Floridan Aquifer well with a pump. Floridan Aquifer wells in the UEC Planning Region provide water by natural artesian flow. Production from Floridan Aquifer wells can be limited by geology of the area, the rate of recharge and water movement in the aquifer, potentiometric head, well diameter and other existing legal users in the area. Typical production rates from Floridan Aquifer wells in the UEC Planning Region can range from 1.1 MGD to 2 MGD.

For much of the UEC Planning Area, the Floridan Aquifer is artesian and flows at land surface without the need for pumps. In most agricultural uses of the Floridan, pumps are not used. For public water supply, pumps are needed to transfer water from the Floridan wells to the treatment facility. Pumping cost vary depending on the volume of water needed. For example, the construction cost for a 1 MGD pumping system is estimated to cost about $72,000 with an annual operation and maintenance cost of $28,000. Whereas, the construction cost for a 5 MGD pumping system is estimated to cost about $132,000 with an annual operation and maintenance cost of $104,000. Site-specific costs associated with reverse osmosis (RO) can vary significantly as a result of source water quality; concentrate disposal requirements, land costs and use of existing water treatment plant infrastructure.

There are additional costs for water treatment for potable uses. As stated above, since water from the Floridan Aquifer is brackish, desalination treatment is required prior to potable use. All utilities that use the Floridan Aquifer in the UEC use reverse osmosis for treatment and most use deep well injection for concentrate disposal. Treatment cost information is provided in Chapter 5 of the Support Document. Estimated cost of reverse osmosis treatment with concentrate disposal via deep well injection including operation and maintenance is $2.15 per 1,000 gallons for a 3 MGD facility to about $1.84 per 1,000 gallons for a 10 MGD facility.

Floridan Aquifer - Quantity of Water Potentially Available

The analysis indicated that the Floridan Aquifer has the potential of supplying, at a minimum, a sufficient volume of water to meet at least 64 MGD of the public water supply demands (2020 PWS projections in 1998 Plan), while meeting the supplemental water needs (125 MGD) of agricultural users during a 1-in-10 drought event. The results of the modeling indicate that there would be no resource protection criterion exceedances. To ensure that the resource is managed properly, the volume of water that could be withdrawn by any specific user must be determined through the District's CUP Program. The analysis did not address water quality degradation (increasing salinity) in the FAS because of increased, long-term withdrawals.

In the UEC Planning Area, the Floridan Aquifer has historically been used regularly by agricultural users, and to a lesser extent, public water supply users for many years. Out of the limited number of Floridan wells that have historic water quality records, some have showed increases in salinity. The modeling did not incorporate a water quality component and sufficient data does exist to perform one currently. However, the modeling indicated that water levels are not projected to decline below land surface over the planning horizon, and the experience in the UEC Region suggests this should not result in significant changes in water quality. As stated previously, continued data gathering from the Comprehensive Floridan Monitoring Well Network for water use, water quality and water levels is recommended. Data from this initiative could be used in modeling of water quality, as well as water levels, for the next Plan update.

Floridan Aquifer - Implementation Strategies

Listed below are potential strategies developed in cooperation with the public that should be considered in the development of plan recommendations regarding the Floridan Aquifer:

A. Continue to collect data from the Comprehensive Regional Floridan Aquifer Monitoring Well Network to better understand the relationship between water quality, water levels and water usage.

B. Develop a density dependent solute transport groundwater model for next UEC Plan Update for predictive analysis purposes.

C. Implement a Floridan Aquifer exploratory well program to gather additional hydrogeologic data to support development of a Floridan Aquifer density dependent groundwater model.

D. Conduct Floridan Aquifer tracer tests to better understand flow paths in the Floridan Aquifer.

E. Refine the Floridan well inventory and increase public awareness of presence of Floridan wells when land is converted to urban development.

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F. Provide technical support of local initiatives in pursuit of decommissioning Floridan Aquifer wells.

Reclaimed Water

Reclaimed water is wastewater that has received at least secondary treatment and is reused after flowing out of a wastewater treatment plant (Chapter 62-610, F.A.C.). Water reuse is the deliberate application of reclaimed water for a beneficial purpose, in compliance with the FDEP and water management district rules. Potential uses of reclaimed water include landscape irrigation, such as medians, residential lots, golf courses and other green space, agricultural irrigation, groundwater recharge via percolation ponds, industrial uses, environmental enhancement and fire protection.

The State of Florida encourages and promotes the use of reclaimed water. The Water Resource Implementation Rule (Chapter 62-40 F.A.C.) requires the FDEP and water management districts to advocate and direct the reuse of reclaimed water as an integral part of water management programs, rules and plans. The District requires all applicants for Water Use Permits to use reclaimed water unless the applicant can demonstrate that it is not feasible to do so.

Existing Reuse in UEC Planning Area

The use of reclaimed water in the UEC has played a vital role in meeting a portion of current demands for irrigation water. The volume of reclaimed water that is used for a beneficial purpose has increased almost 70 percent from 1994 to 2003 as shown in **Figure 9**. Over this period, the volume of reclaimed water reused has varied from year to year depending on the addition of new users and rainfall.

In 2003, there were 28 wastewater treatment facilities in the UEC with a capacity of 0.10 MGD or greater. The largest of these is the Fort Pierce Utilities Authority with a capacity of 10.00 MGD. Specific information on each facility is provided in **Appendix B**. These facilities had a total capacity of over 34 MGD and treated over 20 MGD in 2003. There are three methods of treated wastewater disposal used in the UEC Planning Area: reuse, deep well injection and surface water discharge via ocean discharge.

Twenty-seven of the facilities used reuse for all or a portion their disposal. About 40 percent (8.10 MGD) of the wastewater treated in the planning area in 2003 was reused for a beneficial purpose with over 5.43 MGD used for irrigation. In 2003, reclaimed water was used for irrigation of over 5,400 residential lots, 20 golf courses, three parks, five schools and a citrus grove (FDEP Reuse Inventory, 2003). About 2.20 MGD was used for groundwater recharge and the remainder was used for industrial and toilet flushing purposes. The results of the analysis indicates that current reuse in the UEC, primarily irrigation of golf courses, has contributed to reduced potential resource impacts.

A few of the reuse systems in the planning area have limited expansion potential at this time because their available reclaimed water supply is fully committed/utilized during certain times of the year. However, these utilities have surplus reclaimed water at other times of the year. To overcome shortfalls and maximize the use of reclaimed water, some utilities have developed supplemental supplies, such as storm water and groundwater. St. Lucie West supplements reclaimed water with water from its storm water management lakes, while South Martin Regional Utility uses groundwater to supplement its reclaimed water. The location of wastewater facilities, reclaimed water transmission mains and large users are located in **Appendix B**.

Over 11 MGD of the wastewater treated in 2003 was disposed of by deep well injection. Five facilities have deep well injection systems, four in conjunction with some reuse. Ocean discharge accounts for a very small percentage of the total effluent disposal in the region Only St. Lucie County uses ocean discharge for disposal (via the Florida Power and Light cooling outfall at its South Hutchinson Island Facility) when wastewater flows exceed reclaimed water demand. In 2003, all reclaimed water from this facility was reused and none was discharged to the ocean. The 11 MGD that was disposed of via deep well injection is potentially reusable water.

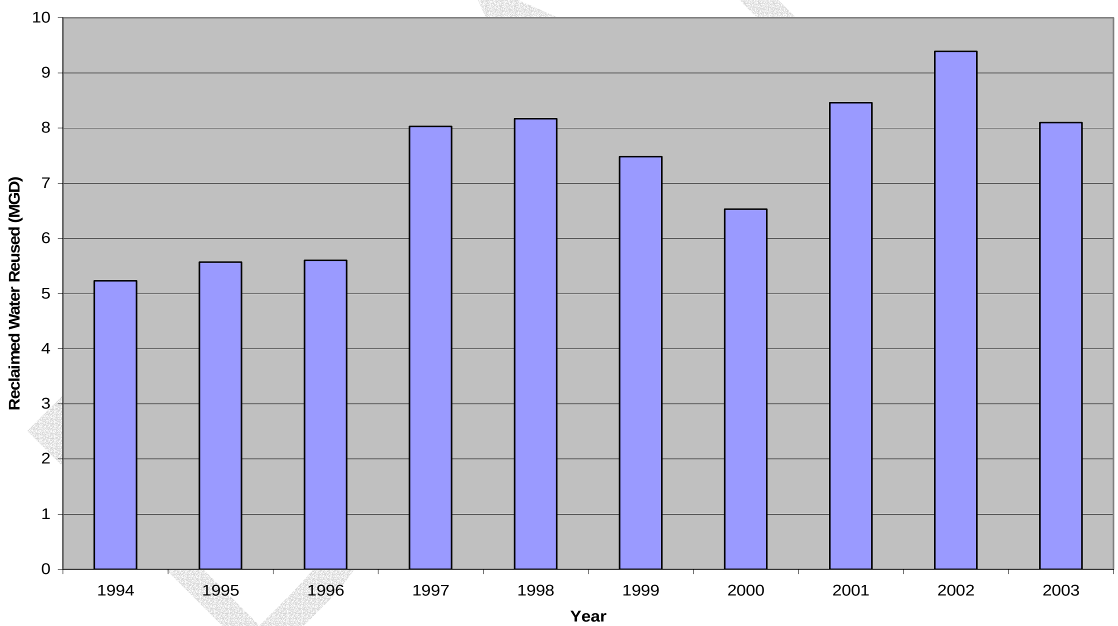

Figure 9. Reclaimed Water Use (1994-2003).

Future Reuse in UEC Planning Area

Wastewater flows are projected to increase to about 40 MGD by 2025. Utilities involved in reuse at this time plan to continue reuse and expand their reuse systems as additional water and users become available. There are several activities occurring at this time that could lead to increased reuse in the future. Port St. Lucie is consolidating and regionalizing its wastewater systems to two regional facilities within the next 8 years: a new Glades facility and expansion of the Westport facility. The primary means of disposal at these regional facilities will be reuse via public access irrigation of residential lots and golf courses. The Northport and Southport wastewater facilities (majority of effluent disposal through deep well injection) will be decommissioned in the future.

The City of Stuart and the Fort Pierce Utilities Authority treat almost 35 percent of the wastewater generated in the planning area, and dispose of the effluent almost exclusively through deep well injection. The City of Stuart is initiating a feasibility study and master plan to identify opportunities for reuse, with a focus on replacing groundwater withdrawals for irrigation in the vicinity of its wellfields. Fort Pierce's wastewater facility is located on South Hutchinson Island and has limited reuse potential because of the lack of uses in the vicinity of the facility both on the Hutchinson Island and the mainland. Fort Pierce, in cooperation with St. Lucie County, will be identifying mainland locations for a wastewater facility(s) to treat future wastewater flows beyond Ft. Pierce's existing wastewater treatment facility capacity. Reuse will most likely be the primary means of disposal for such a facility. An alternative that may be considered in design of the new wastewater treatment facility is increasing the capacity of this new mainland facility to replace the existing capacity at the existing Ft. Pierce wastewater treatment facility.

Reclaimed Water Efficiency and Effectiveness

In addition to new facilities and expansion of existing reuse systems, implementation of water conservation measures, such as metering and volume based rates, will promote more effective and efficient use of reclaimed water. Giveaway programs and use of flat rates encourage overuse of the reclaimed water source. Studies conducted by the Southwest Florida Water Management District concluded that simply providing meters could reduce the use of reclaimed water by residential customers by 50 percent (SWFWMD, 2002). Metering of reclaimed water use and implementation of volume-based charges, in which users pay for at least part of the actual metered volume, are encouraged as a means to effectively manage reclaimed water supplies.

Proposed revisions to Florida's Water Resource Implementation Rule, Chapter 62-40, F.A.C., directs FDEP and the water management districts to encourage reuse that is efficient and effective and will increase potable quality water offset or recharge fraction, where consistent with water quality protection. Potable quality water offset is the amount of potable quality water (Class F-I, G-I or G-II groundwater or water meeting drinking water standards) saved through the use of reclaimed water expressed as a percentage of the total reclaimed water used. Dividing the amount of potable quality water saved by the amount of reclaimed water used, and multiplying the quotient by 100 calculate the potable quality water offset. The recharge fraction is the portion of reclaimed water used in a reuse system that recharges an underlying potable water quality groundwater (Class F-I, G-I or G-II groundwater) that is used for potable supply, or augments a Class I surface water, expressed as a percentage of the total reclaimed water used.

Mandatory Reuse Zones

One tool to increase the use of reclaimed water is through the designation of mandatory reuse zones. Mandatory reuse zones are geographic areas designated by local governments through ordinance where the use of reclaimed water is required. These could be undeveloped areas or developed areas where retrofits will be required. These zones may be very effective in increasing reuse in the undeveloped portions of the service areas in the UEC, where installation of the reclaimed water distribution systems and use of reclaimed water would be required at the time of development. It is much more cost effective to install these systems at the time of development compared to retrofitting existing developments. Palm Beach County's mandatory reuse zone has successfully increased reuse at its Southern Region Wastewater Reclamation Facility.

Reclaimed Water Storage

Because some of the reclaimed water supplies in some reuse systems in the UEC are fully committed during certain times of the year and have a surplus during other times of the year, seasonal reclaimed water storage through aquifer storage and recovery (ASR) may allow some systems to expand their user base. Simply stated, store reclaimed water when supply exceeds demand and withdraw the stored water when demand exceeds supplies. ASR could also be used to store supplemental sources when sources are available for withdrawal in compliance with applicable rule and regulations.

Supplemental Sources

Other water sources could be developed to supplement reclaimed water flows when demand exceeds supplies. St. Lucie West supplements reclaimed water with water from its storm water management lakes, while South Martin Regional Utility uses groundwater to supplement its reclaimed water. These supplemental sources have allowed these utilities to expand their reclaimed water systems.

Reclaimed Water - Estimated Costs

The costs associated with use of reclaimed water can be divided into treatment costs and transmission/distribution costs. The ultimate use of the reclaimed water directly effects the treatment, distribution and costs. For the purposes of this section, the cost associated with developing a public access reuse system will be summarized. Public access irrigation involves using reclaimed water for landscape irrigation, such as medians, residential lots, golf courses and other green space.

All the facilities in the UEC Planning Area provide secondary treatment, with several equipped with treatment components to produce reclaimed water for public access irrigation. For those facilities that have secondary treatment only, treatment would have to be upgraded to advanced secondary treatment. Advanced secondary treatment typically refers to the addition of filtration and high-level disinfection. Estimated costs for construction and operation and maintenance of advanced secondary equipment range from $0.53 per 1,000 gallons for a 1 MGD facility to about $0.24 per 1,000 gallons for a 10 MGD facility.

The cost of transmission and distribution of reclaimed water can be substantial, and varies significantly from rural settings to highly urbanized settings. Systems may consist of a single pipe conveying reclaimed water to a golf storage pond to very complex distribution systems that convey reclaimed water to individual residential lots. The length and diameter of pipe, land requirements, land costs, utilities existing in right-of-way and terrains (sidewalks, driveways, roads, etc.) all affect the cost of transporting and distributing reclaimed water. From projects in Florida, the transmission/distribution cost have ranged from a low of around $0.40 per 1,000 gallons for some large multi-customer reuse systems that are in close proximity to a treatment facility to over $3.00 per 1,000 gallons for retrofit residential areas.

The use of reclaimed water also results in some cost avoidance. These include reducing the use of alternative disposal systems and eliminating the need of another water supply source by the end user. In addition, reclaimed water contains nutrients such that application of fertilizers will be reduced when irrigating with reclaimed water.

Reclaimed Water - Quantity of Water Potentially Available

Most of the utilities in the region have not projected wastewater flows through 2025. To estimate wastewater flows for 2025, the 2003 ratio of wastewater treated to water pumped for public water supply was applied to the 2025 public water supply (PWS) projected water supply needs. In 2003, the ratio of wastewater treated (20 MGD) to water pumped for public water supply (39 MGD) was about 51 percent. The projected PWS demand for 2025 is about 78 MGD (**Appendix A**). By applying the 51 percent ratio to the projected 2025 PWS water demand for the UEC Planning Area, it is estimated wastewater flows will increase to about 40 MGD by 2025. This is all potentially reusable water.

Reclaimed Water - Implementation Strategies

Listed below are potential strategies developed in cooperation with the public that should be considered in the development of plan recommendations regarding reclaimed water:

A. Encourage reclaimed water interconnects between utilities, where appropriate, to maximize use of reclaimed water.

B. Provide incentives for increased efficiency of reclaimed water by providing additional weight to criteria that recognize efficient use of the resource, rewarding applicants to the District’s Water Savings Incentive Program (WaterSIP) and the Alternative Water Supply (AWS) Funding Program with increased scores. This could include metering, volume-based rates, and/or establishment of application rates consistent with the District’s CUP allocation criteria.

C. Provide technical assistance to local governments in establishing mandatory reuse zones (where appropriate) to increase use of reclaimed water.

D. Provide technical support to utilities pursuing reclaimed water aquifer storage and recovery.

E. Develop AWS funding criteria for reuse projects that use reclaimed water efficiently, or are requirements of consumptive use permits.

Reservoirs

This option involves the capture and storage of excess surface water in reservoirs during rainy periods and the subsequent release during drier periods for environmental and human uses. Regionally, surface water storage could be used to attenuate freshwater flows to the St. Lucie River and Estuary, the Indian River Lagoon and the Northwest Fork of the Loxahatchee River and Estuary during rainy periods, and to provide beneficial flows during drier times. In addition, these facilities could increase surface water availability for current and projected uses, and decrease the demand on aquifer systems.

Strategically located surface water storage (primarily storage in combination with improved storm water management systems) could recharge Surficial Aquifer System (SAS) wellfields, reduce the potential for saltwater intrusion and reduce drawdowns under wetlands. Onsite storage in agricultural areas may reduce the need for water from the regional canal system and withdrawals from other water source options. Storm water reservoirs could be located with ASR facilities, and provide a water source for the facility.

Reservoirs - Estimated Costs

Costs associated with reservoirs can vary significantly depending on site-specific conditions of each reservoir, land costs and facilities, such as pumps. A site located near an existing waterway will increase the flexibility of design and management and reduce costs associated with water transmission infrastructure. Another factor related to cost would be the existing elevation of the site. Lower site elevations would allow for maximum storage for the facility, while reducing costs associated with water transmission and construction excavation. Depth of the reservoir will have a large impact on the costs associated with construction. Deeper reservoirs result in higher levee elevations that can significantly increase construction costs. Costs associated with reservoirs are provided in Chapter 3 of the Support Document.

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Reservoirs - Quantity of Water Potentially Available

Reservoirs are considered a management option in that these systems allow more efficient use of other sources, such as surface water. The CERP Indian River Lagoon – South Project Implementation Report (PIR) estimates the project could increase surface water availability by 26,300 acre-feet per year (23.48 MGD). District staff estimate this could result in a decrease of 19 percent in Floridan Aquifer usage for agriculture, further assuring the water needs of the agricultural community.

Reservoirs - Implementation Strategies

The only regional reservoirs proposed in the UEC are through the CERP and the Indian River Lagoon – South Project. Recommendations related to this project are incorporated in the Surface Water section of this chapter. One potential strategy developed in cooperation with the public that should be considered in the development of plan recommendations regarding reservoirs is:

Agricultural operations should incorporate best management practices to include water conservation and water supply considerations in design of new or retrofitted surface water management systems.

Seawater

This option involves using seawater from the Atlantic Ocean as a raw water source. The ocean (seawater) is an unlimited source of water from a quantitative perspective; however, removal of salts (desalination) is required before potable or irrigation uses are feasible. To accomplish this, a desalination treatment technology would have to be used, such as distillation, reverse osmosis (RO) or electrodialysis reversal (EDR).

Seawater - Estimated Costs

The cost of seawater desalination can be significant, several times the cost of brackish groundwater desalination. This is due to seawater's higher and variable salt content, intake facilities and concentrate disposal. The higher and variable salt content reduces the efficiency of the treatment facility (less gallons of potable water are produced from raw water pumped) and results in increased concentrate/reject water disposal needs compared to desalination of the brackish groundwater. Cost information from some non-United States seawater desalination facilities indicates costs can be significant for seawater desalination. For example, in Singapore, a 36 MGD seawater desalination plant was estimated to cost between $7.52 and $8.77 per 1,000 gallons in the early to mid 1990s. In the United States, the cost of seawater desalination has decreased from about $9 per 1,000 gallons for a stand-alone facility to about $3 per 1,000 gallons for a co-located facility between 1990 and 2000 (SFWMD, 2002).

One way to reduce the cost of seawater desalination is to co-locate the desalination facility with power generating facilities that use seawater for cooling. There are many benefits of co-located desalination facilities and electric power plants. One benefit and cost reduction is the sharing of facility components. There is cost savings associated with using the existing intake and discharge structures of the power plant to provide raw water to the desalination plant and to provide a means for concentrate disposal. It is possible to dispose of the desalination process concentrate by blending it with the power plant's cooling water discharge. Using power plant cooling water as a source, the temperature of the water is elevated, which reduces the pressure and associated energy necessary to produce the product water, providing another significant advantage.

Seawater desalination has proven to be economically feasible in some parts of Florida when co-located with power plants. Tampa Bay Water recently completed construction of a seawater desalination RO treatment facility initially capable of producing 25 MGD of drinking water. The wholesale cost for the desalinated water over the next 30 years is projected to average $2.49 per 1,000 gallons. The 25 MGD facility cost $110 million and began producing water in March 2003 (Tampa Bay Water, 2003). Water production has been interrupted due to excessive fouling (plugging) of the RO membranes. Negotiations are continuing to rectify the problems and resolve potential contractual issues.

The SFWMD cost-shared a feasibility study with Florida Power and Light (FPL) to investigate the potential of developing co-located RO water treatment facilities with electrical power plants, a recommendation of the 2000 Lower East Coast Regional Water Supply Plan. The study's findings recommended FPL's Ft. Myers and Port Everglades sites as technically and economically feasible for co-located seawater desalting facilities.

Seawater - Quantity of Water Potentially Available

The volume of water available from the ocean is unlimited and could meet the needs of this region through the year 2025.

Seawater - Implementation Strategies

It was concluded that seawater is a potential alternative source of water that needs future consideration; however, not in the 2025 planning horizon. Based on the projected water demands, other water sources are available to meet projected needs that have lower treatment costs.

Surface Water

This option involves surface water and surface water related environmental supply strategies to ensure the needs of the environment are met. Strategies include minimum flows and levels (MFLs), water reservations, restoration plans, environmental restoration and CERP projects. Surface water includes the direct withdrawal of water from regional surface water sources, primarily the C-23, C-24, C-25 and C-44 Canals, as well as related efforts that involve the capture and storage of excess surface water during rainy periods and subsequent release during drier periods for environmental and human uses. Regionally, this includes reservoirs for storage of surface water that could be used to attenuate freshwater flows to the St. Lucie River and Estuary, the Indian River Lagoon (IRL) and the Loxahatchee River during rainy periods and meet minimum flows during drier periods. In addition, these facilities could increase surface water availability for other uses. In Martin and St. Lucie Counties, increased surface water availability could reduce the use of the Floridan Aquifer for agricultural irrigation. This option also includes increasing flexibility in surface water management by connecting surface water basins.

St. Lucie River and Indian River Lagoon

Freshwater discharges from the C-23, C-24, C-25 and C-44 Canals to the St. Lucie River and Estuary and the Indian River Lagoon have periodically negatively impacted the estuarine system. In addition, periodic, high-volume, prolonged freshwater releases from Lake Okeechobee via the C-44 Canal have also had a dramatic effect on water quality and salinity and the overall health of the estuarine system. A MFL was established for the St. Lucie River and Estuary in 2002. To address the problems caused by excessive flows, the Indian River Lagoon – South PIR has been completed and the USACE and the District are pursuing the incorporation of this Project into the Water Resource Development Act (WRDA) of 2004. Construction of the Indian River Lagoon – South Study and the Ten Mile Creek Critical Restoration projects will address freshwater flows from the watershed; the CERP and possible modifications to the Lake Okeechobee Regulation Schedule, will address freshwater discharges from Lake Okeechobee to the St. Lucie River via the C-44 Canal.

Minimum Flows and Levels

As stated above, a MFL was established for the St. Lucie River and Estuary in 2002. The District realizes that a minimum flow and level alone will not be sufficient to maintain a sustainable resource during the broad range of water conditions occurring in the managed system. Setting a minimum flow is a starting point to define the minimum water needs necessary to protect water resources against significant harm.

Research and monitoring for the St. Lucie River and Estuary MFL is being conducted through ongoing and proposed activities associated with the Indian River

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Lagoon Surface Water Improvement and Management (SWIM) Plan and the Indian River Lagoon – South Project to provide for enhanced freshwater deliveries and track conditions in the system. These programs include periodic water quality sampling and the installation and monitoring of permanent flow and salinity stations at various locations in the estuary and its major tributaries.

CERP Indian River Lagoon - South Project Implementation Report

The purpose of the Indian River Lagoon - South Project was to evaluate means of improved surface water management in the C-23, C-24 and C-25 and C-44 basins by providing increased storage and reducing the need for periodic high-volume discharges, thereby improving habitats in the St. Lucie River Estuary and the Indian River Lagoon and increasing surface water availability. The Final Indian River Lagoon - South Project PIR was submitted to the USACE in Atlanta in March 2004. Approvals are being sought to incorporate the Indian River Lagoon - South Project in the WRDA of 2004. Construction could be initiated as early as 2006, is scheduled to take 6 years to complete and is estimated to cost $1.21 billion. The recommended plan in the Indian River Lagoon - South PIR provides over 135,000 acre-feet of storage via four reservoirs. A map of the recommended plan is located in **Appendix E**. In addition, four stormwater treatment areas are proposed to reduce phosphorus and nitrogen. The reservoirs, with their associated stormwater treatment areas, are expected to increase surface water availability, which reduce demand on the Floridan Aquifer by the agricultural users in the area.

Ten Mile Creek Critical Restoration Project

After many years of planning and design, construction of the Ten Mile Creek Critical Restoration Project was initiated in November 2003. The project involves construction of a 550-acre reservoir (maximum depth of 10 feet) and a 110-acre stormwater treatment area (maximum depth of 4 feet). This project is located immediately west of the Varn (a.k.a. Gordy Road) Structure on Ten Mile Creek in St. Lucie County and will provide storage and treatment of storm water from the Ten Mile Creek Basin, which is the largest subbasin discharging into the North Fork of the St. Lucie River. In addition, the Ten Mile Creek Critical Restoration Project will increase surface water availability to agricultural users in the basin. The construction is scheduled to take less than 2 years to complete and will cost approximately $26 million.

Basin Interconnects

For many years, there has been discussion of connecting the SFWMD's C-25 Basin with the St. John River Water Management District's C-52 and Upper St. Johns River Basin Project. This connection may provide flexibility and efficiency in water management that would allow storage of water that is being discharged to tide. This potential alternative would store water during wet periods and provide water for environmental needs and water supply during dry periods. Participants at the UEC Plan Water Resource Advisory Committee (WRAC) workshops supported further evaluation of this alternative by the two water management districts to determine its potential in

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addressing freshwater flows to the Indian River Lagoon and water supply needs of the region.

Lake Okeechobee Regulation Releases

The Indian River Lagoon - South PIR is addressing surface water management and freshwater flows generated within the planning area to the St. Lucie River. In addition to receiving fresh water from the watershed, the St. Lucie River also serves as a major outlet for Lake Okeechobee. The C-44 Canal conveys flood control releases from Lake Okeechobee to the South Fork of the St. Lucie River. Regulatory discharges are usually large volume releases for prolonged periods of time and drastically change the water quality in the St. Lucie River.

The Lake Okeechobee Regulation Schedule is reviewed periodically to determine if operational changes can be made that have more ecological benefits, while meeting the Central and Southern Florida (C&SF) Flood Control Project objectives. This includes evaluating discharges made to the St. Lucie Canal (C-44). Structural changes are necessary to substantially affect these discharges to the St. Lucie River. These structural changes are incorporated into the CERP. Participants at the UEC Plan public participation workshops agreed that implementation of the CERP to address regulatory releases from Lake Okeechobee to the St. Lucie River is the best approach to this issue.

Loxahatchee River

The Loxahatchee River has been significantly impacted by the creation and maintenance of the Jupiter Inlet that has contributed to the displacement of freshwater wetland communities by estuarine species in areas of the Loxahatchee River where they were not found historically. In addition, construction of the C-18 Canal and installation of drainage projects for agricultural and urban development have lowered water tables and reduced the amount of fresh water available to the Loxahatchee River and significantly altering natural flow patterns.

Progress is being made by the District, USACE and local governments in improving flows to the Northwest Fork of the Loxahatchee River. This process includes structural improvements in addition to policy/regulatory improvements. The Northern Palm Beach County Comprehensive Water Management Plan (NPBCCWMP) was accepted and a MFL has been established for the Northwest Fork of the Loxahatchee River. Recommendations of the 2000 Lower East Coast Regional Water Supply Plan related to the Loxahatchee River are also being implemented.

An initial water reservation for the Northwest Fork of the Loxahatchee River will be established in 2004. By 2005, the existing MFL and associated recovery plan for the Northwest Fork of the Loxahatchee River will be reviewed and revised, as necessary, to be consistent with established restoration goals and future water reservations. MFLs will be established for the tributaries (Cypress Creek, Hobe Grove Ditch, Kitching Creek and Loxahatchee Slough) to the Northwest Fork by 2007.

Northern Palm Beach County Comprehensive Water Management Plan

The Northern Palm Beach County Comprehensive Water Management Plan (NPBCCWMP) was accepted by the District's Governing Board in May 2002 and is being implemented. The purpose of this effort was to develop a collective vision that would meet present and future water resource needs for the northern Palm Beach County area. The NPBCCWMP recommendations will bring about improvements to storage and water conveyance infrastructure that will capture water currently lost to tide in the wet season and provide supplemental supplies in the dry season - meeting environmental needs and projected urban and agricultural demands. The NPBCCWMP identifies needs for the following infrastructure improvements, including:

- 48,000 acre-feet of storage in regional reservoirs.
- 50 MGD of water storage in regional ASR facilities.
- 12,000 acre-feet of additional storage in wetlands and local reservoirs.
- 10 MGD obtained from reclaimed water.

Additional structural features are needed to improve the ability to convey surface water among storage areas, control water levels in the Loxahatchee Slough and provide flow to the Northwest Fork of the Loxahatchee River. The District efforts include:

- Construction of the G-160 Loxahatchee Slough Structure in northeastern Palm Beach County was completed in January 2004. This $2.1 million spillway structure will provide essential freshwater flows to the Northwest Fork of the Loxahatchee River during the dry season and will also maintain a more natural hydroperiod within the slough.
- Groundbreaking for the G-161 Northlake Boulevard Structure took place in early 2004. This proposed $1 million culvert structure would create a flowway from the Grassy Waters Preserve to the Loxahatchee Slough (C-18 Basin). The structure will pass approximately 150 cubic feet per second (cfs) under Northlake Boulevard in Palm Beach Gardens.
- Purchased approximately 44,800 acre-feet of storage at the L-8 reservoir in the L-8 basin. The reservoir is located immediately west of the L-8 Borrow Canal and north of the C-51 Canal in Palm Beach County.

The Northern Palm Beach County Comprehensive Water Management Plan is available from: http://www.sfwmd.gov/org/wsd/npbcwmp/npbcwmp-doc.htm.

Minimum Flow and Level

An initial MFL was established for the Northwest Fork of the Loxahatchee River in 2002 and is codified in Chapter 40E-8, F.A.C. A summary of the MFL for the Northwest Fork of the Loxahatchee River is described in **Chapter 3**. The MFL was adopted to protect the Northwest Fork from significant harm.

After completing the restoration plan and initial water reservations for the Loxahatchee River, the MFL and associated recovery plan for the Northwest Fork will be reviewed and revised, as necessary, for consistency. The MFL Rule was designed with the flexibility to further ensure no significant harm by aligning it with restoration efforts and further information and data becomes available. Establishment of minimum flows and levels for the tributaries (Cypress Creek, Hobe Grove Ditch, Kitching Creek and Loxahatchee Slough) to the Loxahatchee River are scheduled for 2007.

Water Reservations

The MFL Rule for the Northwest Fork of the Loxahatchee River states that the SFWMD intends to adopt an initial reservation by 2004 to protect existing water used for protection of fish and wildlife, consistent with the practical restoration goal identified for the Loxahatchee River. This water reservation will be reviewed periodically and revised in light of changed conditions, such as the changes that will occur in the C&SF Flood Control Project as CERP projects become operational. This provides flexibility to account for changes in implementation strategies and contingency plans during the life of the project.

When developing reservations, all current existing legal uses of water will be protected so long as such use is not contrary to the public interest. Adoption of water reservations will be consistent with state law. To protect water made available for the recovery and restoration of the Loxahatchee River through implementation of some of the projects identified above, the SFWMD intends to adopt water reservations for the Northwest Fork of the Loxahatchee River on a project-by-project basis over the next 20 years.

Future reservations related to the Northwest Fork will be consistent with the reservations being developed for restoration of the Everglades under the CERP, and will reflect the needs of the natural system through a range of hydrologic conditions. These water reservations are intended to prevent the future allocation to consumptive uses of the fresh water needed for restoration of the Northwest Fork of the Loxahatchee River. The reservations will be implemented through the CUP Program, operational protocols, water shortage rules and other appropriate provisions in Chapter 373, F.S.

CERP North Palm Beach County Part 1

This project builds on the findings of the NPBCCWMP. The CERP North Palm Beach County Part 1 is addressing the interdependencies and tradeoffs between the different elements in the NPBCCWMP to provide a more efficient and effective design for the overall project. Project information can be obtained at http://www.evergladesplan.org/.

These CERP projects will provide water for environmental enhancement of the Loxahatchee River, Loxahatchee Slough and Grassy Waters Preserve. The Project Implementation Report is currently under development. The projects will:

- Improve hydrologic connections between protected natural areas.
- Improve Lake Worth Lagoon.
- Reduce dependence on Lake Okeechobee during periods of drought.
- Reduce water lost to tide.
- Improve natural areas within the project boundary.
- Increase water management options.
- Improve the quality, quantity, timing and distribution of water delivery to the Loxahatchee River and Estuary, including the Northwest Fork.

Current Martin County Loxahatchee Basin Activities

Martin County's Office of Water Quality was created to ensure that the County's goals and objectives for protecting, restoring and enhancing the County's rivers and overall water resources are achieved. The Office of Water Quality is responsible for development, design and implementation of capital stormwater projects that improve and enhance local waters. This Office works closely with the SFWMD, FDEP, USACE, as well as related state and federal agencies in developing and implementing the CERP and other related water quality and resource projects that affect Martin County.

The projects summarized below are some of the efforts Martin County has made to enhance water quality and expand wildlife habitat.

Tropic Vista and Little Club. Tropic Vista and Little Club are two stormwater projects that will enhance and improve water quality, timing and volume of delivery of stormwater to the Loxahatchee River. In addition to these benefits, both projects will improve storm water management to address local flooding problems. Martin County has been working with local landowners and Jonathan Dickinson State Park to complete these beneficial projects.

Pal-Mar/Cypress Creek/Hobe Grove. As part of its efforts to assist in restoring the Loxahatchee River, Martin County teamed with the SFWMD, Florida Fish and Wildlife Conservation Commission (FWC) and FDEP, to initiate a study to address water resource related issues in the Loxahatchee Basin. The first phase of the study, funded by the SFWMD with support from its partners, will complete detailed basin modeling. The next phase of work is scheduled to begin in 2004, with funding from Martin County, the SFWMD and private sources, for further investigation of engineering and design alternatives to address these basin issues. The model will provide a basis for optimal management of wetlands on the Pal-Mar property, possible diversion of flow from the C-44 Canal through irrigation infrastructure to supplement flow to the Northwest Fork, identification and management of discharges from the groves and Cypress Creek to the Northwest Fork, and improved flood control for local residences.

Cypress Creek. Palm Beach and Martin Counties and the SFWMD acquired approximately 4,000 acres of the Cypress Creek/Loxahatchee Tract in January 2003. The Martin County lands are under an interim management arrangement with the SFWMD, and more permanent plans for this acreage will be taking shape in the near future. Martin County is requesting state and federal funding for support of design, engineering and construction of facilities that will contribute to the restoration of the Wild and Scenic Loxahatchee River. That request will be submitted within the Loxahatchee River Preservation Initiative for 2004.

Pal-Mar East. The Pal-Mar East Project is comprised of approximately 3,000 acres of historic wetlands that have been converted largely to rangeland. This parcel is essential to the restoration of the Loxahatchee River, and is the final link in establishing the greenway and trail from the Atlantic Ocean to Lake Okeechobee. Martin County is partnering with the SFWMD in order to purchase this land.

Kitching Creek Restoration. This basin's restoration project has been divided into two major components and will include headwater revitalization, rehydration of disturbed wetlands, redistribution of freshwater and restoration of historic wetlands bisected by the construction of Bridge Road (C.R. 708) and Flora Avenue. Benefits of this project component are improvements in the water quality and quantities flowing into Jonathan Dickinson State Park property to the southeast, as well as an increased flood protection level of service for local residences and businesses. Martin County is also working with the USACE to complete a restoration project for the main area of the Kitching Creek Basin. Currently, flows through the Kitching Creek Road Ditch cause erosion, flooding and excessive nutrient impacts to Jonathan Dickinson State Park. Redirection of these flows will be accomplished by the regrading of drainage ditches, providing shallow flowways through existing rights-of-way and county properties and easements. Ultimately, stormwater will be conveyed to Kitching Creek's predevelopment flowway and proposed construction of a berm east of Powerline Avenue will direct flow southeasterly toward Wilson Creek and Jonathan Dickinson State Park. Re-engineering and relocating existing culverts under Bridge Road, installing stormwater treatment ponds, berms and other water control structures will provide attenuation and water quality treatment for this area.

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Surface Water - Estimated Costs

Costs associated with surface water use involve intake structures and pumping facilities.

Surface Water - Quantity of Water Potentially Available

Surface water from the C-23, C-24, C-25 and C-44 Canals are primary surface water sources for agricultural irrigation and inflows to the St. Lucie River and Estuary and Indian River Lagoon. The Loxahatchee River receives inflows from the C-18 Canal and several other tributaries. Significant surface water storage will be provided in the future through construction of the projects summarized above. Development of operating protocols for these systems will determine increases in surface water availability. Water for natural systems from new projects will be reserved from allocation by the SFWMD. The volume of water that may be allocated from the remaining water by any specific user must be determined through the District's CUP Program.

Surface Water - Implementation Strategies

Listed below are potential strategies developed in cooperation with the public that should be considered in the development of plan recommendations regarding surface water/environmental supply:

A. Establish an initial water reservation for the Loxahatchee River to protect existing water used for protection of fish and wildlife, consistent with the practical restoration goal identified for the Loxahatchee River in 2004, pursuant to the MFL established for the Northwest Fork of the Loxahatchee River.

B. Establish MFLs for the tributaries to the Northwest Fork of the Loxahatchee River (Cypress Creek, Hobe Grove Ditch, Kitching Creek and Loxahatchee Slough) by 2007 pursuant to the MFL established for the Northwest Fork of the Loxahatchee River.

C. Review and revise the MFL and associated recovery plan for the Northwest Fork of the Loxahatchee River, as necessary, to be consistent with established restoration goals and future water reservations by 2005.

D. Complete construction of the Ten Mile Creek project by 2006.

E. Actively pursue authorization for the Indian River Lagoon – South PIR, and construct the project to manage of freshwater flows to the St. Lucie River and Indian River Lagoon. Look for opportunities to accelerate land buying, including innovative methods such a transfer of development rights (TDR).

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F. Conduct a study of the feasibility of connecting the SFWMD's C-25 Basin with the St. Johns River Water Management District's C-52 and Upper St. Johns River Basin Project to identify the benefits and estimated costs of such a connection.

G. Continue implementation of the Northern Palm Beach County Comprehensive Water Management Plan to address freshwater flows to the Loxahatchee River.

H. Complete the CERP North Palm Beach County Project Part 1 Project Implementation Report, and implement the findings of that report, as a continuation of the Northern Palm Beach County Comprehensive Water Management Plan.

I. Develop a restoration plan for the Loxahatchee River that incorporates environmental water needs, while maintaining appropriate levels of flood protection.

J. Complete construction of the CERP to address and minimize regulatory water releases from Lake Okeechobee to the St. Lucie River.

Surficial Aquifer System

The Surficial Aquifer System (SAS) is the predominate source of water for public water supply and urban irrigation in the UEC. The Surficial Aquifer is easily recharged from the surface. Wellfields using the Surficial Aquifer can be limited by the rate of recharge and water movement in the aquifer, environmental impacts, proximity to contamination sources, saltwater intrusion and other existing legal users in the area.

The analysis has shown that expansion of Surficial Aquifer withdrawals in the coastal areas of the UEC Planning Area is limited due to potential impacts to wetlands, as well as the increased potential for saltwater intrusion. Additional withdrawals from the Surficial Aquifer in these coastal areas will have to be evaluated on a project-by-project basis.

Surficial Aquifer System Estimated Costs

The costs related to well construction for the Surficial Aquifer System are provided in Chapter 3 of the Support Document. The costs to develop the Surficial Aquifer include drilling the well, pumps and treatment facilities, if necessary. Drilling of a Surficial Aquifer well is a function diameter and depth is estimated to range for a 200 foot well from about $32,000 for a 10-inch diameter well to $57,000 for a 24 inch well. The water that can be withdrawn from an individual well is very site specific and varies across the UEC Planning Area. Production from Surficial Aquifer wells can be limited by the geology of the area, the rate of recharge and water movement in the aquifer, environmental impacts, proximity to contamination sources, saltwater intrusion, well diameter, pump capacity and other existing legal users in the area. Typical production rates from Surficial Aquifer wells in the UEC can range from 0.30 MGD to 0.75 MGD.

Pumping cost vary depending on the volume of water needed. For example, the construction cost for a 1 MGD pumping system is estimated to cost about $72,000 with an annual operation and maintenance cost of $28,000. Whereas, the construction cost for a 5 MGD pumping system is estimated to cost about $132,000 with an annual operation and maintenance cost of $104,000.

There are additional costs for water treatment for potable uses. Many of the treatment facilities in the planning area use lime softening for Surficial Aquifer water. Treatment cost information is provided in Chapter 5 of the Support Document. Estimated lime softening costs for construction and operation and maintenance is $1.38 per 1,000 gallons for a 1 MGD facility to about $0.80 per 1,000 gallons for a 10 MGD facility.

Utilities are beginning to convert traditional lime softening facilities to enhanced lime softening and membrane softening due to the advent of more stringent drinking water standards. The cost advantages of lime softening are in operating and maintenance expenses, where costs are typically 20 percent less than for comparable membrane technologies. One significant advantage of membrane softening over lime softening is the effectiveness of membrane softening in removing organics that function as a precursor to the formation of disinfection by-products, such as trihalomethanes.

Surficial Aquifer System - Quantity of Water Potentially Available

Based on the 1998 Plan analysis and information contained in **Chapter 3**, from a regional perspective, increases in production from the SAS along the coast beyond existing demands appears limited due to potential wetland impacts and saltwater intrusion. However, it was concluded that some further development of the SAS could be accomplished in these areas at the local level through modifications to wellfield configurations and pumping regimes with respect to locations of wetlands and salt water. As a result, additional withdrawals from the SAS in these coastal areas will have to be evaluated on a project-by-project basis.

Surficial Aquifer System - Implementation Strategies

Listed below are potential strategies developed in cooperation with the public that should be considered in the development of plan recommendations regarding the Surficial Aquifer:

A. Develop tools so that Surficial Aquifer modeling can be incorporated into the next five-year update of this Plan.

B. The potential of using the SAS for new and expanded uses should be evaluated on a project-by-project basis.

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C. Water users should consider development of alternative water sources that reduce reliance on the SAS for meeting future demands.

RELATED STRATEGIES

The District will continue to coordinate the 2004 UEC Water Supply Plan recommendations with other regional planning efforts, including development of the Lower East Coast Regional Water Supply Plan, the CERP North Palm Beach County Project Part 1 project, Ten Mile Creek Critical Restoration Project, Indian River Lagoon – South PIR, and others.

UNIT PRODUCTION COSTS FOR WATER SOURCE OPTION DEVELOPMENT

Cost information has been provided throughout this chapter and the Support Document that could be used to estimate the planning-level total cost for different capacities for each of the water source options. This cost information was presented using the same categories in order to provide comparable cost estimates. The water supply cost estimates allow a relative comparison of the total cost for each alternative considered. To ensure this internal comparability, the following cost estimate categories were used:

- Capital cost (including well drilling cost, construction cost, equipment cost, land cost and engineering cost).
- Operation and maintenance cost (including energy cost).

Total costs, which account for all expenditures, are an estimate of life cycle costs and are a function of the total capital costs, the expected life of the constructed facilities, the time value of money and annual operation and maintenance costs. These cost estimates aid in comparing alternatives with differing economic characteristics.

This cost information was used to develop planning-level unit production costs for each water source option (**Table 20**). The unit production cost equals the total costs divided by water production, expressed in dollars per 1,000 gallons. For all source options, the 2002 federal planning rate of 5.875 was used. A 30-year fixed capital asset life was assumed and operating level of 70 percent of capacity was used. To arrive at the unit production costs over the twenty-year planning horizon, the unused capital value at the end of the planning horizon (1/3 of total capital value based on straight-line depreciation) was deducted from the expenditure-based costs. All costs are expressed in projected 2005 dollars.

Because these cost criteria were used in all economic calculations, the relative cost between source options is comparable. However, the unit production costs presented here are not necessarily directly comparable to unit production costs developed in other

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investigations. To be considered comparable, cost estimates must use the same economic criteria.

For most of the water source options, general assumptions were used to generate the unit cost information. These costs can be highly variable depending on the specific situations of users, as reflected in the cost ranges for some of the options. In addition, the availability of water was not considered. Water supply costs vary for a number of reasons including, but not limited to the following:

1. Hydrogeologic and hydrologic conditions relating to the depth to the aquifer, the yield of the aquifer, water availability, degree of treatment required, etc.
2. Economies of scale in spreading fixed costs over a larger volume of output.
3. In an area of slow growth, a larger percentage of capacity can be utilized than in areas of more rapid growth.
4. Depending upon the quality of the raw water and the nature of the end use, different levels of treatment will be needed.

Table 20. Summary of Unit Production Costs for Water Source Options.

Water Source Option	Water Production Range	Unit Production Costs[a] ($/1,000 gallons)
Conservation (Indoor)	Variable	$0.22 - $0.58
Conservation (Outdoor)	Variable	$0.03 - $0.88
Groundwater		
Surficial Aquifer – Withdrawal Only	3 - 20 MGD	$.03 - $.10
Surficial Aquifer w/Lime Softening	1 - 20 MGD	$.73 - $1.38
Surficial Aquifer w/Membrane Softening[d]	3 - 20 MGD	$.88 - $1.66
Floridan Aquifer – Withdrawal Only	3 - 20 MGD	$.07 - $.15
Floridan Aquifer w/Reverse Osmosis[d]	1 - 20 MGD	$1.60 - $2.15
Reclaimed Water	Variable	$.40 - $2.20
Seawater w/Reverse Osmosis	Variable	$1.71 - $8.77[b]
Storage		
ASR	2 - 5 MGD	$.44 - $1.05[e]
Reservoir (4 Feet Deep)	6,000 acre-feet	$.21[c]
Reservoir (8 Feet Deep)	12,000 acre-feet	$.18[c]
Surface Water – Withdrawal Only	Variable	$.03 - $.21[d]

a. All costs are over a 30-year project life and are not discounted. Because of economies of scale, the lower cost represents cost per unit for the greater capacity.
b. Lower cost in range reflects a high degree of special site-specific circumstances.
c. Represents the cost based on physical volume. Per unit cost for water made available is highly dependent on operational regimes and land costs. Deep well injection used for concentrate disposal.
d. Assumes withdrawal from existing surface water source, such as a canal or existing surface water management system. Cost could be significantly higher if separate storage area is required.
e. Varies depending on treatment required.

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CONCLUSIONS

Overall, it is concluded that with continued diversification of supply sources, such as the use of the Floridan Aquifer or reclaimed water, the existing and future water demands can be met with minimal potential impacts. Increased conservation of all water sources could result in several million gallons per day of water savings. Existing water uses have maximized development of the Surficial Aquifer in the coastal areas such that increased withdrawals from the Surficial Aquifer are limited and is not adequate to meet the growing needs of the UEC Planning Area during a 1-in-10 drought condition.

The two primary uses of the Surficial Aquifer in the coastal areas of the UEC Planning Area are public water supply and landscape irrigation. For public water supply, the scenario that showed the most promise to satisfy projected demands was continued use of the Surficial Aquifer at current levels and continued development of the Floridan Aquifer to meet the growing needs for potable water. Conservation, primarily through retrofits of plumbing fixtures in older housing was shown to have significant potential savings in water use.

Landscape irrigation savings could be increased with the installation of rain sensors on existing irrigation systems. Improvements to landscape irrigation systems resulting from urban mobile irrigation lab evaluations can also further reduce outdoor water use. For landscape irrigation, the scenario that showed the most promise to meet future needs was continued use of the Surficial Aquifer at current levels and continued development of reclaimed water to meet the growing needs for irrigation water. Additional withdrawals from the Surficial Aquifer for landscape irrigation may be possible on a project-by-project basis.

For irrigated agriculture, primarily citrus, a combination of surface water from the C-23, C-24, C-25 and C-44 Canals, supplemented with Floridan Aquifer water, is sufficient to meet the existing and projected needs during a 1-in-10 year drought event. Changes in economic condition within the citrus industry have caused projections of increases in the 1998 Plan in irrigated agricultural acreage to be reassessed. Growth in overall agricultural demand from 2000 levels is not anticipated. Construction of storage reservoirs associated with the Indian River Lagoon – South Feasibility Study will enhance surface water availability and reduce reliance on the Floridan Aquifer. Implementation of voluntary best management practices identified by the citrus industry, conversion of seepage/flood irrigation systems to micro-irrigation and the use of the existing agricultural mobile irrigation lab can further reduce agricultural water usage.

The analysis indicates the Floridan Aquifer can support the additional projected demands without exceeding resource protection criteria. The relationship between water levels, water quality and water use needs to be better understood. However, based on limited historic water quality information and projected water levels, significant changes in water quality are not anticipated with the projected demands. Continued collection of

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data towards this end should lead to a better understanding of this relationship. Development of a model to predict potential Floridan Aquifer water quality changes in the future is needed, preferably in time for the next update of this Plan.

Freshwater discharges from the C-23, C-24, C-25 and C-44 Canals to the St. Lucie River and Estuary and the Indian River Lagoon are problematic in maintaining a healthy estuarine system. High volume, prolonged freshwater releases from Lake Okeechobee via the C-44 Canal also have a dramatic effect on water quality and the health of the estuarine system. A MFL was established for the St. Lucie River and Estuary in 2002. To address problems due to excessive flows and to provide additional storage, the Indian River Lagoon – South Feasibility Study Project Implementation Report has been completed and its incorporation into the Water Resource Development Act (WRDA) of 2004 is being pursued. Construction of the Indian River Lagoon – South Feasibility Study recommendations and the Ten Mile Creek Critical Restoration Project will address regional storage and freshwater flows from the watershed; the CERP and possible modifications to the Lake Okeechobee Regulation Schedule will address freshwater discharges from Lake Okeechobee to the St. Lucie River via the C-44 Canal.

The Loxahatchee River has been significantly impacted by the creation and maintenance of the Jupiter Inlet, which has contributed to the displacement of freshwater wetland communities by estuarine species. In addition, construction of the C-18 Canal and installation of drainage projects for agricultural and urban development have lowered water tables and reduced the amount of fresh water available to the Loxahatchee River, which have significantly altered natural flow patterns.

The District, USACE and local governments are making progress in improving flows to the Loxahatchee River. The Northern Palm Beach County Comprehensive Water Management Plan was accepted by the District's Governing Board in May 2002 and is being implemented, in addition to recommendations in the 2000 Lower East Coast Regional Water Supply Plan. A minimum flow and level was established for the Northwest Fork of the Loxahatchee River in 2002. The District has purchased approximately 44,800 acre-feet of storage for the L-8 reservoir in the southern L-8 basin. Analysis is being undertaken through the North Palm Beach County CERP Project, Part 1 modeling initiatives to determine how much more storage will be needed in the future. Construction of the G-160 Loxahatchee Slough Structure in northeastern Palm Beach County was completed in January 2004. This $2.1 million spillway structure will provide essential freshwater flows to the Northwest Fork of the Loxahatchee River during the dry season and will also maintain a more natural hydroperiod within the slough. Construction of the G-161 Northlake Boulevard Structure began in 2004.

An initial water reservation for the Loxahatchee River will be established in 2004. By 2005, the existing MFL and associated recovery plan for the Northwest Fork of the Loxahatchee River will be reviewed and revised, as necessary, to be consistent with established restoration goals and future water reservations. Minimum flows and levels will be established for the tributaries (Cypress Creek, Hobe Grove Ditch, Kitching Creek and Loxahatchee Slough) to the Northwest Fork of the Loxahatchee River by 2007.